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PROCEEDINGS: THE SURGEON GENERAL'S CONFERENCE ON SOLID WASTE MANAGEMENT FOR METROPOLITAN WASHINGTON. 19-20 JULY 1967

Leo Weaver

National Center for Urban and Industrial Health
Cincinnati, Ohio

1967

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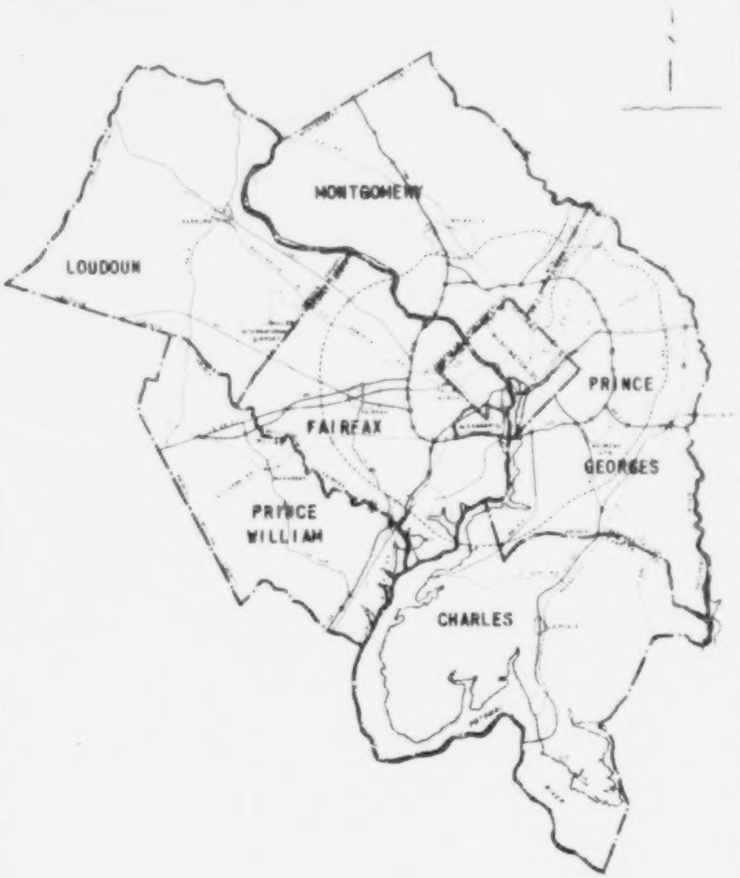
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PROCEEDINGS

The Surgeon General's Conference on Solid Waste Management

FOR METROPOLITAN WASHINGTON

July 19-20, 1967

Edited by Leo Weaver

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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FOREWORD

Several months have gone by since we met to discuss Metropolitan Washington's area-wide solid waste management problems. Since that time, much has happened and I believe significant progress has been made toward the solution of these problems. One important action was the announcement by the Secretary of the Interior and the Engineer Commissioner of the District of Columbia of a timetable of 60 to 90 days for the conversion of Kenilworth from an open burning dump to a sanitary landfilling demonstration for community improvement.

The Kenilworth Dump has long been an ugly, enormous, burning pile of solid waste, befouling the air of our nation's capital with great plumes of smoke. It has been a menace to health in Washington, D.C. and its environs. Unfortunately, in other cities and towns across the nation, similiar dumps pose the same problem.

The idea of getting rid of the Kenilworth Dump was a top priority subject for discussion in the proceedings that make up the subject of this volume. It is a pleasure to be able to report, so soon after the conference, that the meeting stirred prompt action.

But much remains to be done. In calling the conference I stressed that lack of technology is not the real barrier to safe and sanitary solid waste disposal. The barriers are chiefly political and economic. The local governments of the Washington area, working together toward a common solution, constitute the vital force required to achieve the environmental health benefits inherent in effective solid wastes management. The many salutary comments received indicate the conference answered both a regional and a national need. Certainly it has put the Washington area problems of solid waste management in better perspective and created a more favorable environment for innovative solutions.

The conference approach itself is applicable to our many metropolitan areas. The conference format, together with input from the well-chosen speakers with various viewpoints, present in these proceedings a valuable dialogue concerning the problem here in the Washington area and elsewhere in the country.

William H. Stewart
Surgeon General

November 1967
Bethesda, Maryland

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Special appreciation for assistance and cooperation is extended to the staff of the National Center for Air Pollution Control and the Training Program of the National Center for Urban and Industrial Health.

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WELCOME TO THE CONFERENCE

Leo Weaver *

LADIES AND GENTLEMEN: Welcome to the Surgeon General's Conference on Solid Waste Management for Metropolitan Washington.

I have only a few brief remarks to make before we turn to the major business of the conference.

We have some preliminary information on attendance figures based on the list of people who had pre-registered for the conference by yesterday afternoon. These figures are a little out of date by now, but they give some indication of the wide-ranging interest in the subject of this conference.

Of the 310 persons who had pre-registered as of yesterday, 130 represented citizens' organizations, business and professional groups, private industry, and other segments of the community outside of official government agencies. Sixteen Members of Congress or their representatives were pre-registered, 38 State officials, 53 officials of local and regional government agencies, and 73 persons representing the Federal Government.

We will have more up-to-date registration figures as soon as they can be compiled.

Now I would like to say just a word about the organization of the program.

The first plenary session this morning is intended as an introduction to the conference by the two people who had most to do with its being called — the Surgeon General of the Public Health Service, Dr. William H. Stewart, and Senator Joseph D. Tydings of Maryland.

Following these two keynote addresses, Dr. Richard A. Prindle, who is an Assistant Surgeon General of the Public Health Service, will discuss the health implications of the solid waste management problem, a subject that is, of course, of vital interest to us in the Public Health Service, but certainly no less vital to the people of Metropolitan Washington.

The panel session this afternoon is designed to present a status report on the solid waste problem of the Washington area as a background against which the two concurrent panel sessions scheduled for tomorrow morning will proceed to explore the technological and the planning aspects of the overall effort to control the solid waste problems of this metropolitan area.

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* Chief, Solid Wastes Program, National Center for Urban and Industrial Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. On August 1 the Solid Wastes Program moved to the new headquarters of the National Center for Urban and Industrial Health in Cincinnati. Mr. Richard D. Vaughan became Chief of the Solid Wastes Program at that time.

Finally tomorrow afternoon we will hear the reports of the panel chairmen and then I will attempt to summarize what has been said at this conference in terms of a pattern for future action.

In addition to these formal sessions, we have been fortunate in arranging two luncheon meetings at which we will hear two distinguished speakers, Dr. Royce Hanson, President of the Washington Center for Metropolitan Studies, and Senator William B. Spong, Jr., of Virginia, who, with Senator Tydings, has been keenly interested in the development of this conference.

I do not want to delay the business at hand any longer. Let me just say that we are very glad to welcome you to this conference. We are assembled to discuss a subject of urgent importance to the people of the metropolitan Washington area and to the entire nation. I earnestly hope that what we do and say here in the next two days can help to provide a pattern for action that will serve as a model of the best that can be accomplished when people with a common problem come together to figure out how to meet that problem.

INTRODUCTION OF KEYNOTE SPEAKERS

Jerome H. Svore *

THE SURGEON GENERAL has said many times that one of the most serious threats to the health of the nation lies in the environmental hazards of the American cities. This, of course, is where the majority of the people in the United States live today. Thus, he has directed that top priority be given to the work of the Public Health Service in this new center of Urban and Industrial Health.

One of the programs within the Center deals with the subject that we will be talking about here today — namely, solid wastes. The Surgeon General, working closely with Senator Joseph Tydings of Maryland, has convened this conference on solid wastes problems of the Washington Metropolitan area for two reasons: In the first place, he has stated that the time to cope with the serious pollution problems in the District of Columbia and in neighboring Maryland and Virginia, is long overdue. Secondly, he has said that Washington should serve as a model for other cities throughout the nation to emulate in ridding themselves of pollution hazards. I am honored to be able to introduce to you the Surgeon General of the Public Health Service, Dr. William H. Stewart.

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* General Chairman of the Conference, and Director, National Center for Urban and Industrial Health.

CONFERENCE KEYNOTE ADDRESS

William H. Stewart [*]

I AM PLEASED to welcome you to this conference and to share with Senator Tydings the job of sounding a keynote for your deliberations during the next two days. I haven't checked with the Senator to make sure that his keynote and mine are tuned to precisely the same pitch, but I know that he and I agree as to the theme.

Metropolitan Washington shares with every American community the tough, practical problem of what to do with megatons of wastes generated by the processes of modern living. It shares with the larger urban centers the confrontation between the fact of jurisdictional boundaries and the necessity of metropolitan unity.

In addition, Metroplitan Washington bears a unique burden. Our mantle of smoke from smoldering refuse is more than a local nuisance. The dirt and refuse in our alleys is more than a local disgrace. This is the nation's showcase city. The millions who come here should find a model environment. Instead, when they look behind the monuments, they find something less.

I hope that this meeting may represent a step toward that model city we all want for our nation's capital. I hope that in the years ahead we can look back to this day and say that here and now Metropolitan Washington began to create for itself a truly healthful environment.

What kind of a healthful environment are we after? It seems to me that it has two important dimensions.

The first, of course, is the dimension of safety. Later this morning Dr. Prindle is going to talk about the specific health hazards inherent in the unsuccessful disposal of wastes. They are, as you know, numerous.

Some of these hazards relate to the familiar public health problems of communicable disease, the problems associated with filth, rats, and vermin which we know how to control but can never afford to overlook.

Others are newer, less completely understood, harder to handle. These stem from the increasing quantity and variety of chemicals released into the air from many sources including the imperfect burning of solid wastes.

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[*] Surgeon General, Public Health Service, U.S. Department of Health, Education, and Welfare.

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Every year we are learning more about the damage done when we breathe this kind of air, day in and day out. Everything we learn makes control of this kind of pollution increasingly urgent.

Thus the first objective is an environment that is safe, free of specific hazard to health. No individual, no family should be exposed to unnecessary, preventable risk as the price they pay for urban living. This, I submit, is an absolutely minimal objective. Yet in very few places have we achieved even this minimum. Certainly we have not done it here.

Meanwhile we are beginning to aspire to a higher definition of the healthful environment. We have recognized that the healthy person is not merely un-sick. And we are beginning to envision an environment that is not merely safe, but positively conducive to productive and self-fulfilling existence.

The Congress, in its declaration of purpose accompanying the Comprehensive Health Planning Amendments enacted last year, stated this higher goal in these terms: "The fulfillment of our national purpose depends on promoting and assuring the highest level of health attainable for every person, in an environment which contributes positively to healthful individual and family living . . . ".

Where does the Kenilworth Dump fit in that context? Can we find ways of jurisdictional cooperation that will move Metroplitan Washington forward in reaching this national purpose?

This is the second dimension of the healthful environment. It demands concern for sanity as well as sanitation. It involves us in combat with ugliness as well as with hazard.

Happily, the successful disposal of solid wastes moves us forward in both dimensions at once. Unhappily, neither motivation alone nor both combined has yet moved us to the kind of action the situation requires.

What kind of action? It seems to me that two major thrusts are needed. One is national in scope — a serious, large-scale effort to generate new and better ways of disposing of solid wastes. The other is local — a serious, large-scale effort to put into practice, here in the Washington metropolitan area, the best methods now available.

The national thrust is essentially one of research and development. The basic technologies for waste collection and disposal have remained relatively unchanged during a quarter-century in which the size of the problem has magnified enormously. The methods used — incineration, landfill, composting, salvage and reclamation — have been studied here and there, refined in certain ways, occasionally used in an imaginative way. But to my knowledge there has been no great advance.

Neither has there been an effort to achieve such an advance on a scale commensurate with the size of the problem. We spend in the United States upwards of $3 billion to collect and dispose of refuse and other solid wastes. How much have we, as a nation, spent to find a better way of doing it?

This, it seems to me, poses a special sort of challenge for our nation's engineering schools. Increasingly over the years, and at a very rapid rate since World War II, we have looked to the universities and their professional schools for the new knowledge and techniques that change the face of the world. This has been notably true in medicine and in chemistry and physics. It is also significantly true in the behavioral and social sciences.

Is there a partnership evolving in the engineering world between the university and society, similar to these others? My impression is that there is an excellent partnership in improving the means of production and increasing output. What we urgently need in addition is a partnership devoted to problems of consumption and disposal of unconsumed wastes. Having engineered a beer can that is easier to open, we need to engineer a better way of getting rid of the can afterwards.

This is a facetious example of a deadly serious problem. Every day our urban communities produce more than 800 million pounds of solid wastes. I have not the slightest doubt that American science and technology can develop better disposal methods, if we can find a way to harness them to the task. How can we stimulate high priority attention to a problem that has been accorded the lowest of low priorities in the past?

Let us turn now to the local challenge, here in the Washington area. It differs from the national challenge in nature and scope. But it is no less complex, and it is certainly no less urgent. This is the challenge of doing something now to make the Washington area a better place in which to live. For if it is true that existing methods need to be improved, it is equally true that these existing methods, whatever their shortcomings, can be applied to far better effect than they are now, right here in this city and its environs.

You will be spending today and tomorrow searching for ways of doing just that. In your discussions I hope you will base your thinking on the fact that the Washington metropolitan area is essentially indivisible.

I can understand, and even sympathize with, the suburban attitude summed up in the phrase, "Not in my back yard." Unfortunately, however, life in the metropolis is not that simple. The city of Washington is everybody's front yard. Whether or not the smoke from Kenilworth or one of the old incinerators ever blows our way, every one of us partakes of the total environment of the Washington community. This is true of the air we breathe, the water we drink, the transportation we use, and the wastes we accumulate. Going it alone means going it badly; in the long run it also means going it expensively.

The situation here is complicated in many ways — by the unique political nature of the Federal City; by the fact that the District is completely hemmed in with nowhere to expand, nothing to annex; and by other special circumstances added onto the normal complexities of any major metropolitan area.

Yet despite these obstacles there are beginnings of effective metropolitan cooperation in some fields -- sewage disposal, water supply, and others. I see no reason why solid waste disposal cannot be added to the list, from this day forward. In fact I see no reason why it might not set a pattern for improved collaboration in other areas as well.

We in the Public Health Service are eager to help in any way we can. The Solid Waste Disposal Act of 1965 has given us specific mechanisms for assistance for the first time. Our new National Center for Urban and Industrial Health will provide the strongest central focus yet developed for work in this field.

Needed now is a focus and a determination to build a more healthful environment for our national capital and all its people. That, I hope and believe, is what you are here to develop.

KEYNOTE ADDRESS

Joseph D. Tydings *

Mr. Chairman, Dr. Stewart, Ladies and Gentlemen: I am delighted that, under Dr. Stewart's direction, the United States Public Health Service has convened this conference on solid waste management for the Washington metropolitan area. And I am equally delighted at the impressive response shown here today by the leadership of the community. This conference hopefully will mark the beginning of wide-ranging community effort to anticipate, and to find solutions for the burgeoning problems of solid waste disposal in the Metropolitan area.

It seems to me that there are three vital ingredients to successfully meeting these problems. The first ingredient — and in many ways, the most important — is public awareness that the problem exists and public demand that the problem be solved. Recently — but only recently — this public attitude has been evident regarding solid waste problems. The growth of national awareness regarding the hazard of air pollution has been the key. And this growing public awareness has been quite remarkable.

Ten years ago, air pollution activities in most areas of this country were limited to smoke control ordinances. The prevailing national opinion was "if you can't see it, it can't hurt you." In a brief decade, we have realized how short-sighted — how dangerously short-sighted — this view was. Increasing public attention has been focused on the serious health hazards created by pollutants and gaseous wastes in our atmosphere. And the economic consequences of pollution — losses to business and farms — have become clear.

As public concern about air pollution has grown, the link between solid waste disposal and air pollution has become evident. In terms of arousing public opinion, you might even say that we in the Washington area are 'fortunate' to have the Kenilworth Dump in our midst as an object lesson in the link between solid waste problems and air pollution problems. After seeing the full-page pictures of the dump in *Time* magazine a few months ago, some of my colleagues in the Senate suggested to me that my campaign to end the fires might deprive the rest of the nation of a valuable example of what must be avoided. This suggestion could initiate the formation of a national committee to preserve the Kenilworth Dump. I have some different ideas about this, which I'll discuss later.

*** United States Senator from the State of Maryland.**

But we must acknowledge that the Kenilworth Dump has served one constructive purpose — it has dramatized the problem of solid waste disposal for the citizens of this area. And the general national concern regarding the dangers of air pollution has also dramatized the problem for us. Earlier this year, I conducted six days of hearings on air pollution in the Washington area, and one particular incident from those hearings illustrated for me the growth of public awareness of these problems. One of the witnesses at the hearings was S. Smith Griswold, an Associate Director of the National Center for Air Pollution Control. In response to a leading question from me, Mr. Griswold stated that Washington, D.C., was the fourth dirtiest city in the United States. This statement — as I am sure many of you recall — caused something of a furor in the area. The press immediately picked it up, and denials were forthcoming from many sources. "Washington is not fourth dirtiest," some said. "It's the fourteenth dirtiest, or the fortieth dirtiest." But this numbers game didn't fool anyone. The businessman going to his office — where the windows had been washed last month and were now streaked with dirt again — and the housewife taking down her drapes again this year because they were covered with soot — suddenly realized that Washington was a dirty city. And most importantly, they realized that this dirt was not necessary. Something could be done. From that conclusion, it is a short step to say, "Something *must* be done."

I think that step has been taken in the Washington area. That is why all of you are here today. You are here because you are willing to acknowledge our public responsibility to build on citizen awareness of the problem of air pollution and solid waste disposal. You are here to do something about the problems.

Now we must search out the second vital ingredient for meeting the problem. That is the existence of an adequate technology. The basic purpose of this conference is to bring forward the latest technology for meeting the solid waste disposal problem.

We in this area have much to learn. It is obvious to me, from simply reading through the program for this conference, that the participants at this conference have a great deal that they can teach to us.

One lesson is obvious. We must put ourselves in a position to examine the problem, and possible solutions to the problem, from all possible angles. It is not enough for us to assume that the recent trends of vastly expanding per capita production of solid waste must continue. We cannot simply say, "In the next ten years public authorities will be responsible for disposing of an amount of solid waste which will grow at the same rate as has occurred in the last ten years." We must make a determined effort, first of all, to stop the production of waste before it becomes a public responsibility.

For example, when the container industry in the last several years, moved almost exclusively to "throwaway" bottles, cans and cartons to replace the returnable bottles, it had much greater impact than simply removing a good source of income for young boys who were energetic enough to round up a collection of bottles to exchange for the two-cent deposit. Of course, I don't want to minimize that unfortunate result of the movement to "throwaways." But the container industry also brought the nation a vastly expanded public problem of solid waste disposal. I am sure that this consequence was not brought dramatically enough to the attention of the container industry in order to prevent considerable investment in new facilities. In the future, we must be able to anticipate these problems.

Dealing with the container industry was perhaps necessarily a responsibility for the Federal government, in view of the national character of the issue. But whenever new construction, or new production methods, are brought to any locality, local officials must be alert to the possible problems of solid waste disposal that these new methods or new buildings can bring with them. Both through consultation and through regulation, authorities must focus attention on ways to avoid production of more mountains of solid waste.

In short, we must engage in farsighted planning to meet our problems — in this area as in all others. And we must bring to bear all possible technical assistance. The architects who design buildings, the engineers who design equipment, those active in the construction trades who make waste in the process of constructing buildings, and whose buildings in turn make more waste — all of these experts, and many more, must be involved in planning to meet solid waste problems. To paraphrase a famous statement about war, solid waste disposal problems are too complex and too interrelated to the whole functioning of our industrial society to leave exclusively to the sanitation engineers.

Public awareness of the problem is the first step. We have that now. The second step in meeting the problem is tapping all possible technological assistance. We are making an excellent beginning — though only a beginning — at this conference today. The third step which I want to discuss as a vital ingredient in meeting the problem is to ensure that our institutions of government are properly organized to use the available technology for meeting the problem.

To many people, the political problems appear the most intractable. But unless we can solve these problems, we cannot solve our problems at all. The Kenilworth Dump serves, once again, as a dramatic example. After burning and polluting there since 1942, public awareness has finally become sharply focused on the need to eliminate the dump. A variety of technological means were immediately evident for solving the problem — and, as at least a short-run and rapid solution, a sanitary landfill seemed the best candidate. Congress has acted to make funds available. But today the fires still burn.

I do not wish in any way to belittle the difficulties that stand in the way of ending the fires. I don't want to suggest that those citizens who live near the proposed site for the sanitary landfill are in any way wrong to insist that one public nuisance — the dump — must not be replaced by another, closer to their homes. These citizens have legitimate interests which must be satisfied.

Of course, the citizens of the metropolitan area generally have equally legitimate interests in ending the fires and the resultant air pollution at the dump. It is a truism that these fires are a regional problem. The pollution they cause is not restricted to the boundaries of the District of Columbia. Prevailing winds don't restrict themselves to one jurisdiction rather than another.

But even though the Kenilworth Dump is obviously a regional problem, our political institutions at least at the moment seem incapable of viewing, and acting on, the problem with a true regional perspective. Each day that the fires at the dump burn is another indictment of the inadequacy of our institutions of government. If we can't solve this blatant, outrageous problem, I can't see how we can hope to meet any of the regional problems of air pollution control and solid waste disposal, that will confront us in a very short time.

This conference is not only an opportunity for learning, and anticipation of future problems. It is also an occasion for informal consultation, and solution of present problems. I am hopeful that, during the course of these two days, some solution toward ending the fires at Kenilworth will be begun.

The problem does not rest solely on the shoulders of the District officials. Nor should it rest exclusively at the door of the Prince Georges County government. And the problem must clearly not be 'solved' at the expense of the legitimate interests of the citizens living near Muirkirk. The pollution from the fires does not end in the District, nor in Prince Georges County.

The air of the entire Metropolitan Washington area is polluted by the fire. It is inconceivable to me that somewhere among the many resources of this area, we cannot find the means to solve this problem.

For the long run, I believe you should explore the question of whether our regional solid waste disposal problems can best be solved by some formalized system of regional cooperation — perhaps a compact arrangement, or an outgrowth of the Council of Governments, or some other form of regional consultation and cooperation. We cannot depend on improvisation and makeshift arrangements indefinitely. The problems are too great for that. But at the moment, regarding Kenilworth, we have only the possibility of improvisation. And I hope that some inspired improvisation will take place here during the next two days.

Once again, I congratulate the Surgeon General, and the Department of Health, Education, and Welfare, for having convened this invaluable conference. And I congratulate all of you participating in the conference for your awareness of the problems of solid waste management, and your willingness to commit yourselves to solve these problems.

HEALTH ASPECTS OF SOLID WASTE DISPOSAL

Richard A. Prindle *

BY THE YEAR 2000, the population of the United States is expected to double. Our cities and their surrounding urbanized areas are already bearing the brunt of this explosive growth with its accompanying increase in industrial activities. This growth, coupled with the rising per capita rate of refuse production, results in an ever increasing volume of solid wastes that must be regularly collected, transported, and disposed.

Refuse disposal facilities in urbanized areas must be operated without creating public health hazards or nuisances. Too often, however, refuse disposal operations are open dumps — festering scars on the landscape. Flies, rats, and other disease-carrying pests find large quantities of food, a favored breeding medium, in the piles of exposed refuse. The polluted drainage from open dumps is an additional insult to ground and surface water supplies in the area. The characteristic foul odors, produced by decomposition, together with the smoke created by open burning, are often identifiable for miles.

Unless an objectionable dump is nearby, the average citizen's interest is limited to having his refuse collected regularly. This lack of public concern is a real handicap to responsible local officials in obtaining the necessary funds to operate adequate refuse collection and disposal systems. Without sufficient funds it is extremely difficult to plan and construct needed facilities in time to prevent them from being overloaded. The technical problems involved have appeared so deceptively simple compared with other environmental problems that only a handful of communities have maintained sufficient records to enable them to determine the costs of providing this service or to make realistic plans for needed facilities.

Each day, urban communities across our nation produce more than 800 million pounds of solid wastes, and by 1980 that figure is expected to be three times higher. What exactly are solid wastes? They include food wastes (garbage); paper, paper products, wood, bedding, metals, tin cans, crockery, glass, dirt (rubbish) and ashes; dead cats and dogs, sweepings and leaves, and abandoned cars and trucks; food processing wastes, lumber

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* Assistant Surgeon General and Director, Bureau of Disease Prevention and Environmental Control, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C.

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and metal scraps, and cinders from factories and plants; such residue as lumber, masonry, metals, paints, and concrete from demolition and new construction projects; some radioactive materials, explosives, pathologic wastes from hospitals, and so on, from hotels, institutions, stores, and industries.

Collecting and disposing all these wastes is extremely costly. According to the American Public Works Association, the annual outlay for refuse collection and disposal services — more than $3 billion — is exceeded only by expenditures for schools and roads. And still the disposal effort is inadequate. There are only slight improvements in disposal practices now in wide use over those of a quarter-century ago.

The United States Public Health Service recently reported the startling fact that less than half of the cities and towns in the United States with populations of more than 2,500 dispose of community refuse by approved sanitary and nuisance-free methods. Open dumps still flourish, contributing to air pollution and serving as feeding and breeding places for rats and flies. Improperly designed municipal incinerators spew huge quantities of contaminants into the atmosphere. A great number of sanitary landfills are sanitary in name only; they have been allowed to deteriorate and pollute the ground water.

It is necessary to remind ourselves that disposal *of* solid wastes is fundamentally a health problem. Just as we who are concerned with this problem are conscious of the fact that no really new or radically different ideas have emerged in waste disposal operations for half a century, so we must also remember that 46 years ago one of the pioneers in the field laid down three basic requirements for waste disposal. The first was "the absence of danger to public health." And it still holds true. In other words, the barriers and difficulties we face here are, economic and engineering and jurisdictional, but the reason we are concerned is for the protection of the public health.

Let us examine the nature of the various health factors that create our concern.

The most common disposal system of serious danger to health is, of course, the open dump with its flies and rats. Among the diseases that have been directly or indirectly associated with the insanitary open dump are typhoid fever, cholera, summer diarrhea, dysentery, anthrax, trachoma, plague, and trichinosis. The importance of adequate refuse handling in controlling communicable disease was long ago recognized.

Of more important current significance is the fact that in a large proportion of open dumps, the volume of solid wastes is reduced by regular burning and thus adds significantly to the air pollution problem. Improperly designed and operated municipal incinerators also contribute significant quantities of objectionable air contaminants. Added to these sources, backyard trash burners, on-site incinerators, and on-site open burning of bulky refuse contribute additional air contaminants in most communities.

One scientist noted a few years ago that according to data collected in Statewide air pollution surveys "burning dumps cause air pollution problems in about 25 percent of the urban communities of the country. . . . They are the most frequently reported cause for localized air pollution problems."

Water pollution is also becoming a serious factor in the solid wastes problem. Wherever refuse is deposited on land, the impact on surface waters or subterranean aquifers may be significant. The available information concerning the effects of refuse fills on the quality of the adjacent ground water has been organized and reviewed by a research contractor for the California State Water Pollution Control Board. This study was done because the drinking water supply of a major city was becoming objectionable. The study showed that there are three basic mechanisms by which refuse fills can pollute the ground water: (a) horizontal leaching of the refuse by ground water; (b) vertical leaching by percolating water; and (c) the transfer of gases produced during refuse decomposition by diffusion and convection.

From an occupational health and accident prevention standpoint, solid waste handling presents additional formidable problems. A study of the Department of Sanitation of New York City found that arthritis, cardiovascular disease, muscle and tendon diseases (particularly muscle ailments affecting the back), skin diseases, and hernia could all be classified as occupational diseases of refuse collectors. Sanitation workers were also found to have an extremely high injury frequency rate, exceeding that of all other occupations previously studied, with the exception of logging. The study report also observed that "the rate was more than twice as high as that for firemen and policemen, and surpasses even that of stevedores."

Many fires and home accidents are caused by poor refuse handling practices. Discarded items that are not properly stored for collection are also particularly attractive to children. Unsanitary and unsafe conditions in yards and family refuse storage areas have resulted in literally thousands of minor and severe accidents.

While the accident aspect of the problem is in a sense minor, it illustrates the manner in which the problem is growing. If we carelessly bury our solid wastes we run the risk of polluting drinking water supplies, and we also begin to run out of convenient burial plots. If we throw it on burning dumps, we create air pollution and odor nuisances. If we burn it in poorly designed and operated incinerators, we pollute the air, and we must still dispose of the ash.

In an effort to learn more about the public health aspects or disease relationships of solid wastes, the Public Health Service contracted with the Life Systems Division of Aerojet-General Corporation, Azusa, California, to conduct a comprehensive literature survey of the field. Although there is a paucity of past work on the etiologic factors of solid wastes, an attempt has been made to cover the field comprehensively enough to meet the needs of public health practitioners.[1] From the 1,236 articles, books, reports, proceedings, and other sources perused, 755 abstracts were chosen for reference and inclusion in the annotated bibliography.

No single treatise in the past has attempted to correlate the available information as to various diseases directly or indirectly related to solid wastes. Such a work was obviously desirable due to the complexity of the solid waste public health interface.

Solid wastes have been demonstrated conclusively to be associated with some diseases in the United States. Although the incidence of disease due to wastes is low in the country as a whole, it is demonstrably higher in certain population groups — particularly those suffering from a lack of general sanitation, including proper waste disposal means. In the chain of disease leading from waste to humans, the major point of attack must be those wastes which contain disease agents or serve as sources of propagation for carriers of disease. Wastes must be so handled or treated that the pathogens they contain are destroyed, not merely reduced in numbers, and carriers of pathogens denied access to the wastes for breeding or sustenance. To the extent that known effective measures are not feasible at this time, research should be directed at the development of effective yet practical, methods.

Since lack of data is extensive in regard to chemical wastes, two major paths are advised by the Aerojet-General report: (a) delineation of the type and degree of contamination of the environment due to chemical wastes, and (b) accelerated and long-range studies on effects of chemical waste materials common to the environment in the concentrations found there. The knowledge needed is that of the effect of decades of exposure to trace amounts of waste substances.

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[1] **Hanks, T. G.** *Solid waste/disease relationships: a literature survey.* **Public Health Service Publication No. 999-UIH-6. Cincinnati, National Center for Urban and Industrial Health, 1967. 179 p.**

Correction measures against disease cannot deal exclusively with a relatively limited aspect of a health problem as complex as that associated with solid wastes. Educational and legal weapons are required. Considering the deficiencies of health education as a whole in America's school system, it is not entirely appropriate to select the public and personal health aspects of solid wastes as the focus of expanded instruction on health. Yet from a system of education developed on this aspect of health, an inclusive health education program of value might arise. Certainly some means developed for use in the schools is needed for breaking some children from the cultural morass of insanitary practice to which their early environment commits them.

Education of industry, the general public, the medical profession, and government officials is an added requirement. Educational and motivational materials and techniques need to be developed for the accomplishment of these goals. Strict legal controls and their enforcement are mandatory. However, regulations must be based on reasonable standards. At the present level of knowledge, it is not possible to adopt standards directed at all aspects of environmental contamination, including sources of solid wastes. For example, research is needed to permit the development of standards on chemical and other contamination arising from solid wastes. In the interim, considering the tendency of contaminants to ignore jurisdictional boundaries, the legal and governmental means necessary for the effective application of regulatory standards need to be developed.

The Aerojet-General report refers pointedly to the hazard arising from compartmentalized approaches to the control of environmental pollution. In almost every action to be recommended for the management of solid wastes there is a parallel requirement which relates to water- and air-pollution control measures. That is, corrective measures (or research directed at their development) cannot be considered separately from overall waste management problems. The obvious conclusion is that environmental health is not a subject for dissection. Specialists may be required for diagnosis, but the therapy must be unified, and even the diagnostic effort must be integrated. The basic requirement, therefore, is an integrated program of study, analysis, and action.

It is reassuring that at last the nation's solid waste problem is becoming the subject of so much high-powered thinking and planning, as evidenced by the conferees attending this meeting. The attention is long overdue. As President Johnson observed when he signed the Solid Waste Disposal Act in 1965, "Rachel Carson once wrote, 'In biological history, no organism has survived long if its environment became in some way unfit for it, but no organism before man deliberately polluted its own environment.' "

POLITICS AND TRASH

Royce Hanson *

On a number of occasions in my career as an after-dinner or luncheon speaker, I have been accused of talking trash. This, however, is the only occasion where I am willing to concede the point. I hasten to add that my expertise in this subject is limited to my generation of it, and not to its disposal. I assume, however, because I wish so to assume, that the invitation to me to speak at this conference is based not on my contributions to the problem, but on my interest in regional solutions to regional problems, and that the planners of this conference harbored some vague hope that I would find a clever means of fitting their problem into some framework that I felt overconfident about. Inasmuch as I am the region's foremost authority on what voters will not accept in regional ideas, I have decided to talk with you about the political aspects of solid waste management.

That the subject is one fit for political controversy few here would deny. The hearings on air pollution and this conference itself testify to the political mileage and the political misery inherent in such things as the Kenilworth Dump. The problem is how to meet the political problem of solid waste management. I assume that the technical problems are solvable.

What, then, constitutes the political problem? Let me enumerate a few of the factors in the equation. First, there is the factor of money. Political money is different from economic money. Political money is what people visualize something costing, not its cost as measured against time and benefits. Unfortunately for solid waste, its management costs more than a street-crossing light or another policeman, but not as much as a nuclear power plant or a major dam. Waste management falls within that range of public expenditures which is too large to be considered trivial and yet not large enough to be beyond the comprehension of the average householder. There is also something ludicrous about a society spending more to rid itself of its wastes than to feed its poor. It thus falls prey to ridicule. I recall some years ago the defeat, in a state which shall remain anonymous, of legislation to require the cooking of municipal garbage destined for hogs. It progressed well until one of its opponents tagged it the "Hot Lunch for Hogs" bill. I might add that the same legislature wrecked the school lunch program.

*** Luncheon address by the President, Washington Center for Metropolitan Studies.**

In light of these impediments to financing and to a serious debate of the problem, the devising of political strategy becomes very important. A countervailing factor which has already been introduced into the discussion in this area is the contribution made by present outmoded practices of waste management to air pollution. This is a dramatic and potent weapon. Unfortunately, for the ambitions of the solid waste disposers, the fallout from Kenilworth is relatively limited geographically, and hence it is limited politically.

Finding technically acceptable landfill or incinerator locations is sufficiently difficult in itself. Finding locations that are politically acceptable is even more difficult. In some area jurisdiction there is no suitable space. This means two easily recognized political problems arise. We must ask our neighbors to accommodate our refuse . There is, throughout our country a stout resistance to the intergovernmental commingling of waste — especially illicit commingling — such as now occurs when refuse trucks bootleg one jurisdiction's waste to another's disposal facility. Legalizing this traffic will be a problem of some consequence, but convincing some jurisdictions that it is in their own interest to accept other's debris is more difficult. A major job remains to be done by the region and its governments in developing public acceptance of required facilities. The recent concern of residents in Prince Georges County only underscores this point.

A second, even more difficult political problem relates to the hauling problem. I realize that hauling distance and hauling methods are important technical problems. The hauling route is the political problem. What will the trucks pass? What streets will be used? What will their effect be on appearance, on levels of noise, on the safety of the neighborhoods they traverse? No one really likes to live on the road to the dump. The type of vehicle may also be an important consideration in final development of the long-range system Large, enclosed vans may be politically preferable, as well as technically preferable, to a constant stream of load packers or open trucks. This in turn raises other questions about the adequacy of existing regulations of both public and private refuse collection vehicles in the metropolitan area.

We can anticipate a period of agitation by local neighborhood associations sufficient to kill important projects unless the ground is well prepared politically through an extensive information and education campaign, and through sensitive accommodation of local feeling. Otherwise, community response to receiving the regional landfill award will be less than enthusiastic.

An intelligent and sensitive public program can, however, abate if not prevent much damaging hostility.

In conferences of this type there is always much talk of subjecting the problem to a systems approach. I heartily endorse this view, and urge upon you consideration of politics as a part of the system. The key to the politics of the system is the average household, which we often overlook in our focus on delivery and disposal. It is the household, however, which generates the work, and which must be politically satisfied to pay for the technical system. Now, let us look at solid waste management from the household point of view, in the context of our regional waste management objectives.

First of all, the household does not ordinarily view waste management in regional terms, except in the rare case where the head of the house finds it necessary to go to the incinerator or landfill himself. The household is primarily concerned with two politically critical aspects of waste management — getting the stuff off its premises as fast as possible and the neatness of the collection service. There is substantial evidence in many cities that good sanitary services to households is good politics. "Backward" cities such as Lima, Peru, provide daily refuse collection. Local communities in the Washington area have cheerfully paid added taxes for better trash collections. I think these lessons ought not be ignored in developing a regional waste management system or improved local systems. Only a very few ever see the landfill, or comprehend its later uses as a regional asset. Everyone sees and smells his own refuse can, and the litter in his yard or the street. I suggest, therefore, that from a very practical political as well as sanitary engineering and public health point of view, there may be considerable utility in linking new programs to better household service as well as to grand objectives such as abatement of air pollution and ex urban golf courses. Most of us can exist with Kenilworth's fires, but not with a heap of trash composting on the back step. Aside from the political values, it does seem unfortunate that the world's most disposable society can't dispose of its throwaways more efficiently.

Finally, there is the problem of the political responsibility and organization for development and operation of a regional system of waste management. The initial impulse will probably be to create a special purpose authority to handle the problem, give it eminent domain and a protected source of revenue. For myself, I am innately suspicious of this approach, partly because of some of the political considerations I have raised. In addition, a regional system of landfills and incinerators should be developed in the context of a regional plan and regional and local capital budgets. Otherwise, additional political difficulties are certain to occur. The staging of housing development and the planning of transportation facilities is important to both the technical and political success.

In addition, local officials will remain the principal focus of political action, and they should therefore be directly involved in finding a solution and pursuing it. They will probably retain responsibility for what matters to the household — collection. They should therefore retain control over what matters to society — disposal.

It would seem to me, then, that as a minimum, the Council of Governments (COG) is the appropriate organization to provide general policy guidance for development of the system. Since there is, from my point of view at least, a need for immediate action to put out the fires at Kenilworth and to provide other needed planning for the long-range program, there may be a need for a temporary nonprofit corporation, composed of COG directors and staff, to begin the work, prior to the necessary statutes or interstate compacts.

It is in this context that the necessary *quid pro quos* can be developed between refuse producing and refuse disposing jurisdictions. It is in this context that effective planning and staging can take place. And it is in this context that political saleability for the needed system is most likely to occur.

If COG cannot respond quickly and effectively, another approach will have to be devised, but I am confident that the political climate is now conducive to positive and progressive action. Moreover, there is no quicker, surer way presently at hand. I see no reason why, with the work now in progress and the threat of Congressional action, a decision could not be reached within a few months — or even sooner on immediate problems such as Kenilworth. We should, and can, avoid another regional special purpose authority. If we cannot, we will have to undergo another conference at some future date, on the disposal of our governmental waste products, and the answers to that kind of problem are even more complex than those you are considering today.

SOLID WASTE DISPOSAL STUDY FOR THE WASHINGTON METROPOLITAN AREA

L. W. Bremser *

TYPICAL OF MANY large metropolitan areas, the Washington metropolitan region has refuse disposal problems which virtually defy solution except by cooperation between, or among, jurisdictions. Recognizing this, the three principal planning agencies for the metropolitan area, in July, 1965, authorized a study of refuse disposal covering the entire region. The Northern Virginia Regional Planning Commission, the Metropolitan Washington Council of Governments, and the Maryland-National Capital Park and Planning Commission jointly sponsored the study which was partially financed by a grant from the Home and Housing Finance Agency (HHFA). The study has been completed and a review report has been submitted.

The Washington metropolitan region, shown in the frontispiece includes the District of Columbia; Charles, Montgomery, and Prince Georges Counties in Maryland; Arlington, Fairfax, Loudoun, and Prince William Counties, and the cities of Alexandria, Fairfax, and Falls Church in Virginia.

Solid wastes considered included normal residential and commercial refuse plus excavated and dredged materials. Sewage solids, agricultural wastes, and discarded automobiles were specifically excluded.

Principal phases of the study included: (1) determination of the current status of solid waste programs in the region; (2) projection of population and refuse quantities by jurisdictions; (3) study of alternative disposal methods and land requirements for disposal; (4) inventory and evaluation of possible disposal sites; (5) study of transportation methods and costs; (6) recommendations for a long-range refuse disposal program, including specific alternative sites for disposal facilities, areas to be served by each, and comparative overall costs; (7) consideration of administrative and financial arrangements, including possible cooperative or joint management arrangements between jurisdictions.

Current Status

Acceptable refuse collection service is provided in most urban areas of the metropolitan region. Public agencies have assumed responsibility for collecting most residential refuse while private haulers collect from commercial and industrial firms and residences not served by public agencies. Experience demonstrates that satisfactory collection can be provided and managed at the county, municipal, or local level. Regional management of collection is not needed.

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Disposal, although representing only a small part of the cost of refuse service, is more critical. Lack of adequate facilities and space for disposal are problems facing nearly every jurisdiction in this region. In the urban core, disposal space is a pressing need.

Arlington County has no space that can be used for landfill and the City of Alexandria and the District of Columbia are rapidly approaching depletion of landfill space. Natural conditions are generally unfavorable for landfill in Montgomery County. Because of the lack of landfill space, these four jurisdictions have adopted incineration to reduce the volume of solid wastes prior to final disposal. In addition, Alexandria and the District of Columbia burn, on open dumps, large quantities of combustible wastes which cannot be processed in existing incinerator plants.

Existing incineration facilities in Montgomery County, Arlington County, and Alexandria have adequate capacity for present quantities of ordinary incinerable refuse, but will need to be expanded if they are to process the bulky combustible wastes now being landfilled and burned on open dumps.

The District of Columbia needs to double its incineration capacity to handle combustible wastes. In the two to three years that will be required to plan and construct new incineration facilities, the District must either continue to burn combustible wastes on the Kenilworth Dump or must sanitary landfill these wastes outside the District.

Most of the existing incinerator plants in the Washington metropolitan region are not equipped with high-efficiency air pollution control devices. Equipment is available to clean incinerator stack gases to meet air pollution regulations. It is not inexpensive. Presumably, such equipment will have to be added to enable these plants to meet more stringent air pollution regulations expected in the future.

The other jurisdictions in the study area, Prince Georges, Charles, Fairfax, and Prince William Counties, contain land suitable for sanitary landfill. If these four counties will obtain sites now, they can utilize economical sanitary landfill disposal for many years.

Fairfax County operates a landfill which disposes of most of the refuse generated in the county. In Prince Georges County, the Washington Suburban Sanitary Commission's Anacostia sanitary landfill and a number of small municipal and private landfills meet present disposal needs. In both of these counties, however, the space dedicated to sanitary landfill is adequate for overall needs for only a year or two. The Public Works Department of Prince Georges County has developed a long-range County refuse program which, if implemented, will provide a satisfactory solution for disposal needs for many years.

Refuse Quantities

Population of the Washington metropolitan region was estimated at about 2.5 million in 1965. It is expected to increase to 3.8 million in 1980 and to 5.4 million by the year 2000.

Per capita production of refuse for disposal at incinerator plants, landfills, and burning dumps in 1965 was estimated as shown in Table I. Excavated and dredged materials are not included.

A considerably higher per capita production of refuse is indicated for the District of Columbia than for outside areas. This is due primarily to the higher proportion of governmental and business activity and the remodeling and urban renewal work in the District. The relatively low production of refuse in the suburbs reflects the general lack of industry in these areas.

Refuse production for the entire region in 1965 was estimated at 1.3 million tons of incinerables and 0.5 million tons of bulky nonincinerables, for a total of 1.8 million tons (Table I). Here again, excavated and dredged materials are not included.

TABLE I

PER CAPITA REFUSE PRODUCTION

	1965 Refuse Production pounds / capita / calendar day	
Type of refuse	District of Columbia	Outside District
Incinerable	3.60	2.50
Bulky Nonincinerable		
Combustible	0.50	0.30
Noncombustible	1.50	0.45
Total	5.60	3.25

TABLE II

ANNUAL REFUSE QUANTITIES IN TONS

Jurisdiction	1965		1980		2000	
	Incinerable	Bulky non-incinerable	Incinerable	Bulky non-incinerable	Incinerable	Bulky non-incinerable
District of Columbia	535,500	297,000	757,900	421,000	1,079,900	600,000
Maryland						
Charles County	17,100	5,100	36,800	11,000	97,000	29,100
Montgomery County	193,300	58,000	404,300	121,300	772,000	231,600
Prince Georges County	231,900	69,600	492,300	147,700	927,700	278,300
Virginia						
Alexandria, City	52,300	15,700	107,800	32,300	173,400	52,000
Arlington County	78,700	23,600	127,900	38,400	196,400	58,900
Fairfax, City	8,400	2,500	21,400	6,400	34,900	10,500
Fairfax County	146,300	43,900	364,800	109,400	789,200	236,800
Falls Church, City	5,100	1,500	7,700	2,300	11,600	3,500
Loudoun County	13,600	4,100	47,600	14,300	135,700	40,700
Prince William County	37,000	11,100	119,000	35,700	310,200	93,000
Total	1,319,770	532,100	2,487,500	939,800	4,528,000	1,634,400
Combined total	1,851,300		3,427,300		6,162,400	

Table II shows projected annual refuse quantities by jurisdictions in 1980 and 2000 A.D. It is significant that total annual refuse is expected to almost double by 1980 and to almost double again by 2000.

Alternative Disposal Methods

A national effort is being made to develop new and improved methods of refuse disposal. It is entirely possible that better methods than those currently employed will result.

At present, however, sanitary landfill and incineration with landfill of residue and noncombustible wastes are the principal refuse disposal methods available to the Washington metropolitan region. With proper sites, facilities, and operation, either method of disposal will be satisfactory.

Sanitary landfill normally costs $0.70 to $2.00 per ton of refuse, while incineration costs are usually in the range of $4.00 to $6.00 per ton. Because of its lower cost, sanitary landfill should be used where suitable sites are available within economical haul distance.

In general, conditions are suitable for sanitary landfill only in portions of the southern half of the region, principally in Prince Georges County, Charles County, and southern Fairfax and Prince William Counties. Potential sanitary landfill sites of sufficient capacity to dispose of a major portion of the raw refuse from the study area are remote from the urban core and outside the limits of the jurisdictions producing most of the refuse. Such sites may be difficult to acquire, and their use will result in high hauling costs.

Incineration of refuse to reduce the volume for final disposal by landfill is the most practical means for disposing of combustible wastes generated in jurisdictions lacking suitable sites for sanitary landfill. These include the District of Columbia, Montgomery County, Alexandria, Arlington County, and Loudoun County.

Disposal of bulky nonincinerable wastes, a difficult problem in jurisdictions lacking landfill space, can be facilitated by shredding. Shredded material can be processed in conventional incinerators and salvable ferrous metals can be economically separated magnetically.

Land Requirements for Disposal

Landfill space is necessary for any refuse disposal method because all methods leave a residue which can be disposed of only by dumping on the land or in water. Landfill space requirements can be reduced materially by incinerating combustible wastes, by shredding bulky wastes, by salvaging and reusing materials where feasible, and by compacting wastes to the minimum practical volume.

Projected maximum and minimum landfill space requirements, by jurisdictions, are shown in Table III. Maximum requirements shown are for sanitary landfill of refuse without processing for volume reduction. Minimum space requirements are premised on maximum volume reduction by incineration or other processing methods prior to landfilling. The tabulation indicates that sanitary landfilling of all refuse would require about 3.5 times as much space as would be needed if wastes were processed for volume reduction. In addition to requiring less disposal space, the residue of incineration and other reduction processes will make a more stable and useful landfill than raw refuse. Many sites that are not suitable for disposal of raw refuse can be used for incinerator residue and other relatively inert wastes.

TABLE III

LANDFILL SPACE REQUIREMENTS

	Cumulative landfill space requirements in acre-feet			
	Minimum		Maximum	
Jurisdiction	1980	2000	1980	2000
District of Columbia	5,155	16,026	16,784	52,764
Maryland				
Charles County	158	709	584	2,630
Montgomery County	1,771	6,916	6,575	25,688
Prince Georges County	2,167	8,355	8,044	31,032
Virginia				
Alexandria	492	1,754	1,827	6,510
Arlington County	627	2,016	2,327	7,488
Fairfax County	1,659	6,992	6,162	25,972
Loudoun County	175	954	653	3,541
Prince William County	446	2,277	1,658	8,455
Total volume	12,650	45,999	44,614	164,080
Land area required for average fill depth of 20 feet — square miles	1.0	3.6	3.5	12.8

Inventory Of Potential Disposal Sites

Land for landfills and incinerator plants is the greatest present and future refuse disposal need of the Washington metropolitan region. The region does not have the natural conditions which make sanitary landfill an ideal refuse disposal method for some large urban areas. For example, it does not have the expanse of desert which offers economical and pollution-free landfill sites for cities such as El Paso, Texas. Neither does it have the deep, dry gravel pits and dry mountainous canyons within the urban area and within the limits of the jurisdiction producing the refuse which provide excellent landfill sites in Southern California.

Geological and hydrological conditions in the northern half of the region are generally unfavorable for sanitary landfill. Soil is shallow; springs outcrop in most valleys and ravines; and much of the area is within watersheds of public water supplies.

Conditions are more favorable for sanitary landfill in the coastal plains region comprising the southern half of the area. Here, soils are deeper; less of the area is in watersheds of public water supplies; and there are extensive marshlands which might be reclaimed by sanitary landfill. The southern area contains sufficient suitable land to permit sanitary landfilling of all refuse from Prince Georges, Charles, Fairfax, and Prince William Counties for many years.

However, sanitary landfill sites could be difficult to acquire. Many of the sites are planned for other uses and much of the land is expensive. Gravel excavations are shallow and can be reclaimed for development. Underwater excavations are not suitable for sanitary landfill. Most marsh areas are planned and reserved for conservation and park use. Much of the undeveloped land in Virginia is in watersheds of public water supplies where sanitary landfills could pose a threat of water pollution. Much of the land suitable for sanitary landfill is in outlying and sparsely populated areas which produce little refuse.

Prince Georges County contains sufficient potential sanitary landfill sites to meet its needs to the year 2000. But, space for long-term sanitary landfilling of refuse from other jurisdictions, such as the District of Columbia, is not available unless filling of marshland currently planned for conservation and park use can be permitted.

The potential sanitary landfill sites in Fairfax County would be adequate for the needs of the county and the cities of Falls Church and Fairfax until about 1985. Fairfax County, however, could not provide long-term sanitary landfill sites for other jurisdictions such as Arlington County and the District of Columbia. It does contain several potential inert fill sites located on

Federal and other lands which could accommodate incinerator residue and inert wastes from these jurisdictions for many years.

Isolated areas in the southern extremity of the Washington metropolitan region could accommodate all refuse from the region until the year 2000. However, transportation cost would be high and legislative and legal action would probably be necessary to establish regional disposal facilities there.

Consideration of increasing refuse quantities and the limited amount of landfill space in the Washington metropolitan region leads to the conclusion that more incinerator plants will be needed in the future. Good incinerator plant sites are limited now and will almost certainly become increasingly difficult to find as the region develops. Therefore, those jurisdictions which will need incinerator plants in the future should acquire plant sites now while they are still available.

Transportation of Solid Wastes

Hauling refuse from the collection route to the point of disposal is a significant factor in the cost of refuse service and must be considered in evaluating disposal methods and sites. Truck haul costs may range from $0.10 to $0.50 per ton-mile (based on one-way distance and including the cost of the return trip).

Best opportunities for reducing haul costs are: minimizing haul distance, minimizing labor involved in hauling, and increasing payload. Transfer to, and haul in, large capacity vehicles may be feasible under certain conditions. Use of multiple disposal sites should also be considered as a means for reducing haul costs.

The cost of hauling incinerator residue to distant disposal sites can be minimized by the use of large, self-dumping, tractor-semitrailer units. All jurisdictions operating incinerator plants should give consideration to economies afforded by larger ash haul vehicles.

Barging will be a feasible method for transporting incinerator residue and nonincinerable wastes to landfill sites accessible from the Potomac River and a considerable distance downstream.

Haul by rail also may be feasible. Railroads presently are investigating the cost of providing this service.

Summary

The bulk of solid wastes operations can be managed at the local level by proper application of present techniques. The problem has been defined.

No magic solutions are in sight. Each jurisdiction must initiate solutions to as much of the problem as possible.

Some of the problems can be solved only by cooperation among major jurisdictions. Interjurisdictional cooperation or a regional authority will be needed to handle problems incapable of solution at lower levels. On the other hand, the solid wastes problem cannot be escaped by total abdication of local responsibility to a higher authority.

The time for local action is now.

AIR POLLUTION AND SOLID WASTE DISPOSAL PRACTICES

John T. Middleton *

I AM PLEASED to have an opportunity to participate in this conference. I think we can all agree that, for the most part, current waste disposal practices in the Washington area are not only obsolete, but are an insult to our senses and a source of many problems affecting public health and welfare. The refuse produced in this area is being disposed of in ways that contribute to all of our environmental pollution problems, ways that represent a sheer waste of valuable resources, and that make our surroundings increasingly ugly and offensive.

Among the many problems associated with refuse disposal in the Washington area, air pollution is clearly the most obvious and the most serious. I know, as I am sure all of you do, that many diverse factors must be taken into consideration in developing a practical plan for disposal of solid waste in this or any other urban area. Effective control of air pollution is just one of those factors, but it is one which cannot be ignored. No solution to the refuse disposal problems of our modern society can be truly acceptable if it perpetuates those waste disposal practices which add unnecessarily to the burden of air pollution.

No doubt, most of you know that the Secretary of the Department of Health, Education, and Welfare, John W. Gardner, has called for Federal action to abate interstate air pollution in the Washington area. An abatement conference will be held later this year, probably within the next few months. We are currently in the final stages of a technical investigation of the sources and extent of the area's air pollution problem and of its impact on public health and welfare in both the District of Columbia and the suburbs. This investigation is providing, among other things, a full appraisal of the extent to which open burning and incineration of refuse are contributing to air pollution in the Washington area.

I believe that Secretary Gardner's reasons for initiating interstate air pollution abatement action in this area and the Surgeon General's reasons for calling this conference on solid waste management had one important thing in common. That one thing was an awareness that both air pollution

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and refuse disposal are basically regional problems, whose solution will, in very large measure, require coordinated regional action.

In the seven months that I have been in Washington, I have seen many indications that this need for regional action is recognized to some extent by local officials and citizens of the area; certainly, the activities of the Metropolitan Washington Council of Governments are evidence of some recognition that the various communities in the area cannot fully solve their air pollution and refuse disposal problems on a do-it-themselves basis.

For the most part, however, these facts do not seem to be widely enough appreciated to serve as a basis for constructive action. There seems to be a marked tendency to believe that all, or nearly all, of the area's air pollution, particularly air pollution arising from solid waste disposal, originates in the District of Columbia. This is a myth; it is a myth that must be dispelled, once and for all, if the people in the Washington area are to succeed in ridding themselves of the air pollution problems associated with refuse disposal.

Estimates based on preliminary data from our current technical investigation indicate that an overwhelming share — about 80 percent — of all the refuse produced in the Washington metropolitan area is currently burned. Only 20 percent is buried in landfills. This means that of the estimated 1.5 million tons of refuse disposed of each year in the area, approximately 1.2 million tons are burned. Municipal incinerators, including the four in the District of Columbia and those in Alexandria, Arlington, and Montgomery county burn 680,000 tons. Some 160,000 tons are burned in open dumps — most of it, of course, in the Kenilworth Dump, and smaller amounts in dumps located in Prince Georges County, in Maryland, and in Prince William County and Alexandria, in Virginia. All other incineration by commercial, industrial, and residential equipment scattered throughout the area, poorly equipped, if at all, for control of air pollution, accounts for 206,000 tons. Backyard trash burning accounts for 108,000 tons.

Open burning and incineration of refuse are sources of several important types of air pollutants, including carbon monoxide, hydrocarbons, and particulate matter. The most obvious, of course, is particulate matter — the brown and gray smoke that shrouds the area and reduces visibility, and the flying fragments of half-burned trash that accumulate on cars and window sills and blacken buildings and monuments. But the obvious effects are not the only effects. Not all of this airborne filth ends up on cars and buildings; some of it inevitably ends up in our lungs and other parts of the human respiratory system, where it has been known to have irritating or toxic effects, or both.

In the Washington area, refuse burning accounts for an estimated 22 percent of all the particulate matter released into the air from all sources. Among the various categories of air pollution sources in the area, only power plants account for a greater share of particulate pollution. The actual amount of particulate matter released into the air from refuse disposal operations of all kinds is estimated to be about 8,600 tons per year. About two-thirds of the total comes from sources in the District of Columbia, with the Kenilworth Dump contributing about half of that, while the other one-third comes from sources in suburban Maryland and Virginia.

The most obvious conclusion we can draw from these figures is, of course, that efforts to reduce air pollution from refuse disposal operations in the Washington area can most profitably be concentrated in the District of Columbia. This is indeed a valid conclusion. There can be no doubt that closing of the archaic Kenilworth Dump is an essential first step. This action would, in itself, keep more pollution out of the air than would any other single step we can take. But it is important to recognize that no such step will be truly fruitful, in the long run, if action is not also taken to develop a coordinated regional plan for dealing with the solid waste problem.

I believe that a brief look into the future will indicate what I mean. As I said earlier, our estimate is that about 1.5 million tons of refuse are currently discarded in a year's time in the Washington metropolitan area. But this total will increase as the area's population grows and as consumption of goods and services increases. Furthermore, since most of the area's growth is taking place in the suburbs, it is in Maryland and Virginia that refuse disposal problems will inevitably grow at the fastest rate. In the long run, then, the view that refuse disposal is strictly a local problem will have its most serious effects in our suburban communities. This one consideration is, in itself, a compelling argument in favor of regional cooperation in dealing with this problem.

Exactly what form a plan for regional action might take is a basic question which I hope this conference will consider very carefully. No matter what you decide, however, there are several fundamental considerations that cannot be ignored if you are to break the sinister link between refuse disposal and air pollution.

The best solution is, of course, to stop all burning of refuse. This is no easy matter in an area such as this one, where 80 percent of all refuse is disposed of by burning. I am certainly not suggesting that you place an immediate ban on both open burning and incineration. But what I am suggesting is that you explore all potentially practical ways of dealing with the refuse problem without lighting any fires.

I, for one, cannot believe that this area is employing sanitary landfilling to the fullest extent possible. I know that many people who would otherwise have no objection to landfilling suddenly find it objectionable if a landfill site is to be located in their own neighborhood. Their attitude is easily understandable in an area where so little landfilling is done, where few people have had an opportunity to see that landfilling need not be a public nuisance or health hazard. To those people who are concerned about these problems, I can only say that properly operated sanitary landfills make better neighbors than even the best incinerators.

Though the Washington area, like any other in this eastern megalopolis, must eventually run out of suitable space for landfilling, this approach will at least give you enough time to experiment with other approaches. I assure you that there are others, including some which are already in use and some which are still experimental; you will undoubtedly hear about many of them before this conference is over. I urge you to think at least as much about the real possibilities inherent in each one as you do about the seeming limitations. In this era of technological miracles, the ways of collecting, transporting, and disposing of refuse can hardly be limited by our ability to design and build the necessary hardware; the only real limitation is the extent to which all of us are willing to accept, or at least examine, new ideas.

We must also be ready and willing to give up some old and cherished notions. One that may well have to go is the idea that every large building should have its own incinerator. In particular, the installation of single-chamber incinerators in new buildings is an obsolete practice that should no longer be perpetuated. Though such incinerators may be relatively small factors in the area's total air pollution problem, each one is a major source of pollution in its own neighborhood. And where many buildings are crowded together, even in areas far removed from the Kenilworth Dump, the fallout from apartment-house incinerators must make many people wonder whether it is so desirable, after all, to live in the city. It is likely that until we recognize the true nature and extent of the growing waste disposal problem and vigorously pursue more adequate solutions, some waste will have to be disposed of by burning. If we must burn waste, it would be far better to burn it in modern and well-operated municipal incinerators. I will concede that there are not very many of those, either in this area or elsewhere in the country. But in the past few years, largely because of the stimulus provided by the Solid Waste Disposal Act, incinerator technology has begun moving forward; moreover, large municipal incinerators can be equipped with highly efficient secondary collectors such as precipitators or scrubbers for the control of air pollution. No municipal incinerator anywhere in the country is currently equipped with such devices; however, under a grant from the Public Health Service, the District of Columbia is developing plans for a new incinerator that will incorporate the best available pollution control techniques, and New York City recently announced plans to add such equipment to its municipal incinerators.

In the future, if additional community incinerators prove necessary to meet the Washington area's needs, regional cooperation will be essential. In particular, it will be only through regional cooperation that full advantage can be taken of opportunities to locate such facilities in outlying areas, where conditions for diffusion of air pollutants are, as a rule, more favorable than in congested urban areas, and where modern, well-operated incinerators need not be a problem. Since increasing amounts of refuse will be produced in the suburbs, hauling need not be burdensome, and a compelling desire coupled with ingenuity will assure the development of new techniques which will reduce the expense.

There are no quick and cheap ways to deal with the problem you have come here to discuss. I believe that there is ample evidence in the Washington area to demonstrate that short-cut ways of disposing of refuse are the most expensive, in the long run. I have also seen a great deal of evidence which suggests that the people of the Washington area want cleaner air. That goal can be reached only through conscious planning on a regional scale. If a plan existed, we would not be here today. If this group cannot take at least the first steps toward the development of a rational and practical plan, then none of us should be surprised if the people of this area eventually begin to insist upon drastic measures. The more than two million people who live in this area ought to be able to discard their trash without having it returned to them through the air.

SOLID WASTE HANDLING BY FEDERAL INSTALLATIONS

Fred W. Binnewies *

IN HIS NATURAL BEAUTY message on February 8, 1965, President Johnson said, "The beauty of our land is a natural resource. Its preservation is linked to the inner prosperity of the human spirit . . . Our land will be attractive tomorrow only if we organize for action and rebuild and reclaim the beauty we inherited." And Secretary of the Interior Stewart Udall commented in much the same vein, "Yesterday's conservation battles were for superlative scenery, for wilderness, for wildlife. Today's conservation battles are for beautiful cities, for clean water and air, for tasteful architecture, for the preservation of open space." We can hardly win the battle for beautiful cities and clean water and air unless the problem of waste disposal is solved. As the President said, we must organize for action and rebuild and reclaim the beauty we inherited.

Waste disposal is certainly not a new problem but it has been with us in increasing importance for many centuries. The old cliff dwellers of the Southwest merely threw their broken pots and trash, including a few bodies now and then, out the front door. Often, enough fill accumulated so they could build on top of it as much as we do now. This practice, I must say, has been much to the delight of present day archeologists who depend on trash dumps to give them clues to the culture and ways of life of the people of those times. Think what a lot of fun archeologists of the future will have delving in the dumps we are now creating. What kind of an impression will they have of our civilization?

Our problem today is not to make it so easy for those future archeologists but to devise better, more efficient, ways of getting rid of waste materials. The challenge is nowhere greater than here, in the nation's capital, the home of more than two million people, visited by an estimated 15 million more each year. Almost all of the visitors use the National Capital Parks, administered by the National Park Service of the Department of the Interior, in one way or another, and many leave a calling card in the way of trash. A great deal of our effort is spent just cleaning up after people. Over 300,000 cans of trash were picked up and disposed of last year.

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* Assistant Regional Director, Operations, National Capital Region, National Park Service, U.S. Department of the Interior, Washington, D.C.

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Most of the waste collected in the National Capital Parks is disposed of by burning in incinerators or dumps operated by the District of Columbia or other municipalities. For example, we use the incinerator at Mt. Olivet and West Virginia Avenue, N.E., dump unburnable material at Kenilworth, and also use the incinerators at Georgetown and Alexandria. Tree trimmings, branches, and trunks that cannot be disposed of by chipping are burned, in small quantities, 2.5 tons per day, at the District of Columbia plant nursery.

A disposal problem for which there is no good solution at present is what to do with trees affected by Dutch Elm disease. Many of the American Elms in the District of Columbia are infected with the disease and unless the tree is destroyed soon after the elm disease is identified other trees can be infected. Burning is the surest method of disposing of infected trees. Incineration has been tried but it does not work well due to the length of time it takes to consume large tree trunks or stumps. An incinerator can be tied up for days while other trash continues to accumulate. Considerable research is being conducted in an effort to find an effective control for the disease but until it is successful we must continue with open pit burning.

The disposal of waste needs to be a cooperative effort but this is not always the case. Montgomery County, Maryland, has passed an ordinance prohibiting the dumping of trash originating on Federal property on any city or county dump. This affects portions of the C&O Canal National Monument since it would be less costly and more efficient if county facilities could be used. I understand from the newspapers that Prince Georges County has passed a similar ordinance prohibiting trash trucks from the District from operating in the county. This, of course, compounds the problem in this highly concentrated metropolitan area.

Waste disposal is a costly business at best and it is going to get more so as greater emphasis is given to clean air and water. The National Capital Parks spend about $500,000 annually for sanitation activities and $200,000 for Dutch Elm disease control and other tree work. The cost goes up each year despite the fact that the public is getting more litter conscious. We had a good example of this public awareness just the other day. The morning after the Fourth of July we found trash baskets overflowing, but the excess litter was piled around the baskets and not scattered over the landscape. This made our job much easier, and we really appreciated this kind of concern on the part of the general public. There are two things that would help immeasurably to reduce waste disposal problems — make paper so expensive we couldn't afford to throw it away, and develop a beer can that would disintegrate soon after it was discarded. Neither of these are very practical, I'm afraid.

Some good can come from solid waste disposal. For example incinerator ash is being deposited as fill in Kingman Lake and when completed it will be used for a golf course. The Kenilworth Dump is gradually being covered with dirt and it will be turned into an attractive park and outdoor recreation area when completed. Dyke Marsh is being filled with dirt and it will be developed for recreation. The problem, of course, is what is to be done with the trash when these places have reached their limit. There are not many places where landfill can be used to an advantage and they are becoming more scarce each year. With the scarcity of land available for parks and recreation areas, however, cities, counties and states should not overlook the potential of developing recreation facilities on reclaimed dump areas. In fact this can be an incentive to help overcome local objections in order to establish sanitary landfill sites.

Vast improvment can be made in waste disposal if we will only do it. More efficient incinerators can take the place of open burning, scrap metals can be reclaimed, and some method can be developed to pulverize and reuse brick and concrete. I heard recently of a company in Florida that is processing garbage into compost. Proposals have been made to use the heat from incinerators for generating electricity or other beneficial use. This can cut down the expense of waste disposal. I feel sure modern technology can develop better methods for waste disposal if we will give the incentive. Conferences such as this can provide that incentive.

SOLID WASTE HANDLING BY FEDERAL INSTALLATIONS

William H. Eastman *

IT IS INDEED AN HONOR to participate in this conference which deals with the enormous problems in the disposal of waste materials which we in the Washington, D.C. area, generate during our daily activities.

Let me take a minute to give you a word picture of the mission of the General Services Administration (GSA). From our GSA regional office in Washington, the largest of ten throughout the nation, we service virtually every United States Government agency in the states of Maryland, Virginia, West Virginia, and the District of Columbia, with an organization that employs approximately 12,000 people. We served as landlord, purchasing agent, and superintendent, with sundry other management functions. We have some measure of management responsibility for almost 1,300 government-owned buildings and leased facilities, representing approximately 55 million square-feet of space.

Ladies and gentlemen: The people who occupy these 55 million square feet generate tons of waste material daily. This waste manifests itself in several forms: such as, waste paper, trash, debris, classified paper and films, sewage, and other singular disposal items. Each of these items must be handled in a special manner.

The practice and procedures used in the disposal of waste paper, trash, and debris must be closely coordinated. For example, waste paper mixed with trash increases the quantity of trash which we must pay to have removed from our buildings and decreases the quantity of waste paper which can be sold.

Let me take a few minutes to define some types of waste generated in our buildings and how we in GSA handle the disposal of these materials.

Waste paper, scrap materials, and refuse are classified as follows:

Saleable paper. When we talk about this type of waste we refer to all kinds of paper such as the waste paper deposited in the waste baskets located at each of our desks — high-grade type paper generated in printing plants — tabulating cards, books and corrugated containers. Through committee

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studies, initiation of disposal practices, and, most important, education of our employees, we were successful in recovering, in FY 1966, approximately $350,000 from the sale of waste paper alone. As a point of interest, within the past few years waste paper tonnage has jumped from about 50 tons per day to about 90 tons per day (in the Washington area). The collection and disposal of this type of waste paper is handled in several different ways. In some of our buildings, many tons of the paper are baled by GSA employees, and these bales are picked up by contractors at regular established times and dates. In other locations, saleable waste paper is placed in either disposable paper bags or in reusable canvas bags and then picked up by the paper company which has the waste paper collection contract.

Nonsaleable paper. We have an accumulation which consists of paper cups, cartons, carbon paper, and the like. Since we must pay to have the nonsaleable paper removed from our buildings, our buildings supervisors conduct frequent inspections to ensure that the established handling procedures are being followed in order to minimize our trash problem.

Trash. This includes all burnable refuse such as (but not limited to) scrap, lumber, crates, boxes, and unsaleable paper. We must pay a flat monthly rate for the removal of trash. The removal of trash and debris is let to the lowest contract bidder for a period of one year.

Debris. When we speak of debris, we are talking about nonburnable trash such as plaster, wallboard, brick, stone, tile, and so forth. Debris from our buildings is removed by commercial contractors. We pay by the cubic yard for the removal of debris.

The scrap metal generated in our buildings is collected, classified, and stored as ferrous and nonferrous metal. Both are disposed of by selling to the highest bidder. Several years ago disposal of burned out fluorescent light tubes was a very costly item, and a dangerous operation because these tubes were thrown on the debris pile and disposed of by hauling to the dump. We now have installed in several of our large buildings, a machine which crushes the tubes, thereby permitting ease in handling the disposal of these items. During the course of our monthly operations, we generate hundreds of 55-gallon drums, these drums are collected at a main collection point, as are old tires, tubes, and storage batteries and these items are also sold by our property disposal people. By educating our employees and by initiating sound disposal procedures and practices, we were successful in recovering approximately $700,000 last year from the sales of all types of waste, as compared with about $327,000 in fiscal year 1964.

During the planning stages for the construction of new buildings, we in Public Buildings' Service review the proposed building plans and make recommendations for the installation of modern machinery such as paper pulpers, paper maceraters and other types of waste disposal units to alleviate or assist in the disposal problems. Classified papers and film for example are disposed of by one of three different methods: incineration, wet-pulping, and dry disintegration or hammermills.

There are 20 incinerators in GSA Region III buildings, all agency-operated. Two of them are equipped with afterburners and wet scrubbers for removing odors and fly ash. The remaining 18 are essentially natural draft installations without devices for fly ash control. Surveys have been made on these 18 units, and corrective measures, making them acceptable from an air pollution standpoint, have been determined. Two incinerators are designed for the destruction of animal wastes, 18 for the incineration of classified wastepaper with several of these 18 for the burning of classified film as well. The biggest problem encountered in the operation of these incinerators is the discharge of fly ash to the atmosphere. Wet pulping installations are used in some of our buildings for the destruction of classified wastepaper. The largest wet pulping plant operates eight hours per day, five days per week, and processes eight to ten tons of dry classified wastepaper per day. Equipment of this kind destroys paper effectively and does not create an air pollution problem. However, first costs are high, and there are problems associated with corrosion, maintenance and disposition of the baled wet pulp.

Paper disintegrators or hammermills effectively destroy classified waste paper by reducing it to a dry pulp with complete loss of identity. At the same time they destroy items like paper clips, staples, rubber bands, film, metal plates and glass slides. A hammermill installation requires a water spray to control dust and explosion hazards. One such plant is in operation three shifts a day, seven days per week and produces about 20 tons per day of completely disintegrated classified wastepaper in the form of baled dry pulp. This pulp is sold to a paper pulp processor for industrial reuse. The great bulk of Federal buildings administered by General Services Adminstration discharge their sanitary wastes to municipal sanitary sewers. This sewage is then conveyed to municipal sewage treatment plants for treatment, and does not constitute any further solid waste disposal problem.

The Virginia sewage disposal plant is an exception to this rule in that it is a self-contained plant, operated in its entirety by GSA Region III. It is located about 500 feet southwest of the Potomac River boundary channel and one-half mile northwest of the Potomac River lagoon. This plant treats the sewage from the Pentagon, Federal Building 2, Naval Facilities engineering command building and the South Post residence halls of Fort Myer. An average of 1.1 million gallons per day (MGD) of domestic wastes receives secondary treatment in the Virginia (Pentagon) sewage treatment plant. Peak flow rates of 2 MGD occur, and are adequately handled since the plant was designed for a flow rate of 3.2 MGD. Chlorine is added to the effluent as it leaves the outfall pipe to the boundary channel which leads into the Potomac River. The digested sludge after being dewatered in the vacuum filter and air dried is used by the National Park Service as fertilizer and soil conditioner in the numerous parks in the area.

Many 'one time' disposal problems arise that require special attention. For example, the Public Health Service, GSA emergency supply depot, at Cheetam Annex, Williamsburg, Virginia, is responsible for the storage or pre-position hospital units. These pre-position hospital units are completely equipped field units which can be sent to selected emergency sites throughout the country in times of need. PHS professional advisory committees continuously make quality control checks on supplies and equipment which are a part of these units and recommend the disposal of items which have deteriorated and have been determined to be professionally unacceptable for use. Disposal procedures guidelines for the disposition and destruction of deteriorated items in the medical stockpile depots are issued by the Stockpile Management Branch, Division of Health Mobilization. On May 1, 1967, a memorandum was sent from the PHS stockpile management branch to the PHS GSA emergency medical supply depot at Cheetam requesting the disposal of intravenous injections sets. The Cheetam depot now has the job of disposing of some 2.5 million injection sets. The guidelines as set by the stockpile management branch state that all consumable items will be completely destroyed by burning, crushing, and then burying, unless contents are entirely consumed by incinerations. The GSA personnel at Cheetam decided to dispose of the condemned injection sets by burning. However, the attempts to dispose of these units by burning proved unsuccessful because of the large amount of air pollutants which were created and which threatened surrounding countryside and the city of Williamsburg. It was then decided that the most feasible and safe method to use for disposal of these units would be crushing and burying. A potential health hazard was thus aborted by careful implementation of approved disposal procedures.

Another 'one-time' problem to which GSA is now seeking a solution has occurred at the GSA/PMDS depot at Curtis Bay, Maryland, where large quantities of thorium nitrate, a rare low-level radioactive-chemical element, are stored. These chemicals at the depot are both foreign and domestic in origin. The domestic material was stored in fibre drums with polyethylene liners, while the foreign material was stored in metal 55-gallon drums with one or more liners. Both types of materials in their drums are then stocked on pallets and placed in storage sheds at the depot. Over a period of time it was discovered that the drums and liners in which the thorium nitrate was stored had somewhat deteriorated and several of the drums were leaking. The decision was made to repack the chemicals, and this was accomplished by depot personnel using approved safety procedures. After the repacking operations had transpired, tests were made to check for any radiation contamination which may have resulted from the leakage and the repacking operations. Contamination of a low-level intensity was found on the pallets and also on the flooring where the drums had been located. The disposal of the contaminated flooring and pallets has been a unique problem. Fear of polluting the air with radioactive material prohibits burning as a solution. At present the contaminated material, both pallets and flooring, which have been removed from its original location have been secured pending a solution to the disposal problem.

Yes, GSA is indeed involved in problems of solid waste disposal. Our realm of responsibility extends from the relatively insignificant task of emptying a trash can to the monumental aspects of preventing a potential health hazard to large communities. We at GSA are extremely interested in contributing to the development of modern disposal practices in each and every one of the disposal activities in which we are involved.

ABANDONED AND SCRAP AUTOMOBILES

William A. Vogely *

THE AUTOMOBILE has greatly changed life in the United States in the past 50 years. From a luxury in the early days which only a few could afford, the automobile today has become a necessity which brings many benefits to all of our people. It has brought us problems too, one of which is the problem of disposal of abandoned and scrap automobiles, and about which I wish to talk today.

The rate at which cars are being junked has become so great that the esthetic problem of unsightly "graveyards" and abandoned and rusting hulks is now a matter of public concern.

Old, neglected cars are very durable and difficult to conceal. Abandoned on the streets or on public or private property, they detract from the appearance of urban neighborhoods and the rural countryside. When gathered together in dumps or graveyards, they create an eyesore which, in recent years, has grown to the point where steps are being taken to control it in many communities.

From the national viewpoint, these vehicles, in the aggregate are a major raw material resource. They provide a source of millions of tons of remelted metals each year and hereby reduce the rate of depletion of nonrenewable mineral reserves. Automobile scrap has been processed and sold by the scrap metal industry for decades past, but in recent years this operation has not kept pace with the rate of accumulation of junked automobiles. Although the production of steel is at a record level, the use of scrap iron has declined substantially because of changes in steel technology.

The Bureau of Mines Survey

In order to provide basic factual information on the scope and size of the problem, the Bureau of Mines in 1965 made a fact-finding survey of the auto wrecking industry, the ferrous scrap processing industry and other elements pertinent to the problem. The primary objective was to identify the factors that influence the accumulation and movement of automobile scrap. Because of the desire to obtain reliable information as quickly as possible, and because the problem is not only complex, but also nationwide in scope, a sample surevy was made rather than a comprehensive mail

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* Assistant Director, Mineral Resource Development, United States Bureau of Mines.

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canvass. Fifty-four districts representing a variety of urban, suburban and rural conditions throughout the United States were selected. These districts were classified into the following general categories: (1) urban areas with iron and steel based industrial economies; (2) urban areas with commercial or other than iron and steel economies; (3) suburban areas adjacent to each of the two types of urban areas just mentioned; (4) rural areas in proximity to industrial complexes, and (5) rural areas an appreciable distance from any urban economy.

In carrying out the survey, Bureau engineers interviewed 186 scrap processors and 1,075 auto wreckers throughout the country. Police, county and state officials also supplied comprehensive information on auto graveyards, abandoned cars, junk cars on private property, and local laws and regulations. The interview data were used to prepare a complete analysis and factual report on each study area.

The information obtained in the interviews was used to prepare a report titled *Automobile Disposal — A National Problem* which can now be purchased from the Government Printing Office. This report sets forth the factors which influence the movement of auto scrap from the auto wrecker, through the scrap processor and to the steel mill for use in the production of new steel. Major scrap consumers, brokers and trade associations provided significant information on technologic factors and their influence on the competitive position of automotive scrap relative to other types of steel scrap. Additional information on statutory regulations that affect scrap operations was obtained from officials of certain cities having more than 100,000 population.

A compilation of some of the vital statistics obtained in the survey indicated that the total population of the 54 areas surveyed was about 15.8 million, annual car registrations totaled 6.5 million, or 1 car to about every 2.5 people, and a total junk car inventory of 510,000 of which 73 percent was in auto wreckers' hands, the remainder being abandoned in auto graveyards and elsewhere and consequently outside the normal industrial flow. One of the most interesting facts uncovered was that the annual rate of acquisition of junk cars by the auto wreckers in the survey areas was only about 1.3 percent in excess of their rate of disposal to scrap processors. In other words, the junked autos which move into the industrial flow through the auto wreckers yard apparently are accumulating at a low rate.

Factors Causing the Accumulation of Junk Automobiles

There are many factors influencing the accumulation of junk automobiles and during the course of the Bureau survey, a list of over 80 such factors was compiled. A given factor may be predominant in one area and relatively insignificant in another. Conditions vary so widely throughout the country that each area must be considered individually.

Before we review some of the more important causes of junk auto accumulation, let us pause for a moment and briefly review the process which takes a junked or abandoned car off the streets and through the auto wreckers yard until it disappears from public view. If an old car has been abandoned on a public street, the owner probably didn't leave the car's title in the glove compartment for the convenience of the police. In many jurisdictions, the junk car must be held for a period of time, usually from 30 to 90 days, while an attempt is made to locate the owner. Consequently a wrecker truck is called to haul it off to the police impounding lot, — at the expense of the local government, of course. After the waiting period is over and no owner has been found, the legal paper work of clearing the title must be completed and the car auctioned off at public auction or turned over to an auto wrecker. The latter often has a contract with the local government and gets paid to take the car away to his lot where he lines it up with all the other junked automobiles. That is where the general public usually sees it and where it may sit for more than a year, perhaps several years, before it is finally stripped of reusable parts or salvageable metals, such as the carburetor, starter, generator, battery, wheels, doors, radiator and radiator grill, bumpers, and so on. Once stripped, it is passed on to the scrap processor and finally out of public view.

Auto wreckers usually operate in one of two ways: (1) park the vehicles in yards and strip the parts as they are required for sale, or permit the customer to remove them; and, (2) strip the vehicles to the bare hulk immediately, and either place the parts in storage, or sell them to rebuilders or wholesale outlets, the stripped hulk being passed on to the scrap processor in a minimum of time. Economic factors such as the local demand for parts, inventory taxes, land values, storage space, and community pressures influence the method of operation. The size and location of the yard are of major concern to the operator and the cost of land usually is dependent on land utilization in the surrounding area. The expansion of a yard, the establishment of a new yard, or even the continued existence of a yard may often be subject to control by zoning ordinances. Rural areas usually have few restrictions pertaining to land use and in general rural land is relatively inexpensive and easily acquired.

Individual owners sell, give, or sometimes pay an auto wrecker to take a junk car. The transaction depends on the auto wrecker's appraisal of the value of the car for reusable parts and on the prevailing prices for automotive scrap. Many wreckers dislike to take old model vehicles which have little or no parts value, and can only be resold as scrap. The preparation of a junked car for sale to a scrap processor often involves the stripping of copper wiring, copper radiator, generator and other copper containing items, removal of zinc die cast parts such as carburetor, door handles, and trim, the battery for recovery of lead, the nonmetal parts, and other similar items. In studying some of the technical problems of auto wrecking, the Salt Lake City Laboratory of the Bureau of Mines dismantled two typical vehicles to determine their metal content. To give you an example, a 1954 Chevrolet hulk yielded over 2,790 pounds of ferrous metal, 35 pounds of copper and copper alloys, 21 pounds of lead, 41 pounds of zinc alloys, 8 pounds of aluminum alloys, and 363 pounds of nonmetals.

Most of the combustible materials such as upholstery fabrics, plastics, rubber, grease, undercoating, fibreboard, felt and insulation on wiring are generally removed by burning in the open where no air pollution laws are in effect. Open burning is prohibited in many areas and consequently hulks must be transported outside of the restricted zone for burning. In some metropolitan areas processors have installed special incinerators but these installations are expensive and hand stripping may be the chosen method. However, hand stripping also is time consuming and consequently expensive and the stripped material must be trucked to a public dump, an incinerator or an open burning area for disposal.

An important element in vehicle disposition costs is transportation. An old car may be delivered to the auto wrecker by the owner under its own power or it may be towed behind another car or tow truck. The auto wrecker himself may purchase late model wrecks and haul them to his yard with his own equipment. Some large operators travel long distances using auto transport trailers and acquire six or seven vehicles on one trip.

The processor usually receives from one to seven hulks at a time from the wrecker by truck delivery depending upon the type of truck used. If the hulks have been flattened, as many as 20 or 30 can be loaded on a flatbed truck or trailer.

Independent collectors in some areas obtain junked autos from owners, municipal pounds and elsewhere and deliver them to the scrap processor, thereby providing an important service especially in areas where the auto wrecker refuses to accept older model vehicles.

Sometimes the collector will take stripped hulks from the auto wrecker's lot and deliver them to the scrap processors thereby providing transportation facilities. The collector often will be required to haul the stripped hulk out of an area where burning is prohibited, and burn it elsewhere before delivering it to the processor. Occasionally it is necessary for the collector to flatten hulks for the shredder market especially when long-distance transportation is involved.

Such factors as the prevailing prices of scrap, availability of flatteners, transportation rates, and the existence of price allowances for long-distance shipments determine the distance that hulks can be transported.

Scrap processors sort scrap into various grades, cut or shred it into usable sizes and bail or press lighter gauge material into bundles of proper dimension and density. The processed scrap is sold either directly to the steel mills, to foundries or to brokers in carload lots.

Brokers usually handle the purchase of scrap by locating and supplying adequate quantities of scrap of the quailty needed by the steel mills. The mill determines whether the scrap is satisfactory and acceptable for remelting. The brokers also represent scrap processors in negotiations for any adjustments proposed by the mill.

Processed scrap is generally transported by rail, barge, or ship. The processors located far from consuming mills and foundries find themselves at a definite transportation cost disadvantage in competing with prices near the steel mills. The cost of transporting materials which compete with scrap such as pig iron, iron ore, and iron pellets also has an effect on scrap movement.

The legal framework within which the disposal of worn-out automobiles takes place has a strong influence on their movement and on disposal facilities. Many municipalities have regulations prohibiting the abandoning of automobiles on public property, but often times state laws are the only restrictions. Ordinarily no penalty is provided for leaving a vehicle on ones own private property, but occasionally abandonment on another persons' private property is prohibited. The mode of enforcement and penalties vary widely.

The zoning regulations applying to auto wreckers and scrap processors are many and varied. In urban areas operations usually are restricted to special industrialized zones. Some zoning regulations require fencing or camouflage for new operations and also for nonconforming establishments. New auto wrecking operations are prohibited in some urban areas and many cities limit expansion of current facilities while others require issuance of a permit by the zoning board. Auto wrecker and processor license fees are required by some municipalities and charges may range from $10 to $650 a year depending upon yard size, inventory, or gross sales. Many cities have occasional or periodic inspection systems. In some cases restrictions are also placed on other nuisances such as dust, noise, air and water pollution.

Ordinances, laws and regulations in existence today contain many features which encourage the movement of automotive scrap. There is one deficiency in the legal framework which aids in the accumulation of junk cars and that is the fact that the owner of the vehicle usually can abandon his vehicle on his own property without penalty or financial expense. This problem is now being solved in some areas by enacting license requirements, abandonment penalties, by special provisions in zoning laws or by levying of personal property taxes on all automobiles in possession of the owner irrespective of their operating condition. A statutory requirement which places inescapable responsibility on the vehicle owner, whether a private citizen, operator of a wrecking yard, or scrap processor, and gives him an incentive to pay the cost of moving vehicles toward consumption as automotive scrap could effectively prevent the further accumulation of junk cars and could lead to the gradual reduction of the total inventory of junked vehicles in the nation.

The Bureau of Mines survey obtained data which can be used in a number of ways to estimate the magnitude and other characteristics of the national junk car problem. The survey indicated clearly that a large number of junk cars are in the United States, that they are widely distributed, that a large proportion is visible to the public and that the bulk of the inventory of junk cars is in the yards of auto wreckers and scrap processors. Estimates of the total number of junked cars in the United States vary widely and statements in the press from time to time have implied that the total may be of the order of 20 to 40 million. The Bureau of Mines Survey indicates that the number may not be that large. Based on the 54 representative areas surveyed, the figures indicate an average of 83 junk cars per 1,000 population in rural areas and 26 cars per 1,000 population in urban and suburban areas. If these figures are assumed to be valid nationally, the national total of junk cars approximates 9 million.

In summary, the evidence obtained in the case studies made by the Bureau of Mines indicates: (1) a large number of factors influence the accumulation of automobile scrap and conditions differ so greatly from area to area that the local influence of individual factors varies widely; (2) junk automobiles are being salvaged and remelted at a high rate, but there are many areas in which economic and technical factors are so disadvantageous that movement of automotive scrap is being impeded; (3) price has a strong effect on the prompt movement of scrap from the automobile salvager to the ultimate consumer under present use patterns. Price of scrap also has an effect on the auto parts salvage industry in determining the payment at which the market for scrap becomes so attractive that the movement of autos in and out of the auto wreckers' yards is speeded up and the volume of vehicles that bypass the wrecker is increased. Distance from wrecker to processor which is reflected in transportation costs is a critical factor in this pricing situation. Higher scrap prices especially would stimulate the movement of vehicles having little or no used parts value; (4) changing technology is affecting the structure of the scrap processing industry itself particularly in the areas in which shredders have been built. Introduction of shears suitable for the production of automotive slab, and improved systems of stripping and baling automotive scrap also are having effects not only on industry structure, but also on markets. These methods are making available to the steel mills processed scrap with improved chemical qualities and in a variety of physical forms; (5) changes in automotive design and material specifications could have an effect on auto scrap accumulation rates. Commonly copper and other nonferrous metals contaminate iron and steel in a manner that renders them difficult and expensive to remove and tends to degrade the quality of ferrous automotive scrap; (6) the high scrappage rate and existing inventories of junked cars in wreckers and processors yards, auto graveyards and elsewhere continue to keep the disposal problem in the public eye. Junked cars cannot be eliminated from the scene, but almost complete utilization can be achieved and the esthetic problems reduced to a minimum. Existing laws and regulations or enforcement practices often permit the owner to abandon or neglect the disposal of his vehicle without penalty. This deficiency results in esthetic and public disposal problems. Statutory requirements that place financial responsibility for disposal of the vehicle on the owner provides an incentive to movement toward consumption as automotive scrap; (7) if consumption of the entire supply of junk vehicles is to be an objective of public policy, automotive scrap must be given competitive advantages over other types of ferrous scrap through price reduction, quality improvement, or development of new markets.

The automobile disposal problem is but one of the solid waste problems. I would like to take a moment to apprise you of other aspects of the work going forward in this area.

The Solid Waste Act of 1965 spelled out the scope of the activities of the Department of the Interior as follows:

"The Secretary shall conduct, and encourage, cooperate with, and render financial and other assistance to appropriate public authorities, agencies, and individuals in the conduct of, and promote the coordination of, research, investigation, experiments, training, demonstrations, surveys, and studies relating to the operation and financing of solid waste disposal programs, the development and application of new and improved methods of solid waste disposal and the reduction of the amount of such waste and unsalvageable waste materials." For Interior, this mandate relates to the problems of solid waste resulting from the extraction, processing, or utilization of minerals or fossil fuels where the generation, production, or reuse of such waste is or may be controlled within the extraction, processing, or utilization facility or facilities and where such control is a feature of the technology or economy of the operation of such facility or facilities.

In order to implement the intent of the Solid Waste Disposal Act the Department of the Interior, through the Bureau of Mines, has embarked on a two-pronged program. One is to define the solid waste problem and suggest some avenues of attack for solving the problem and the other is to conduct and stimulate research activities in an attempt to substantially reduce the mounting burden stemming from our society's propensity to generate solid waste.

By July 1968 we will have published a comparable study to the junked car, on solid waste generation from mining and processing activities. This effort will be a case study report which will highlight the major geographic locations with solid waste problems of this type.

Based on this latter effort, the Bureau has selected certain 'representative' problem areas and will, during this fiscal year, conduct an engineering-economic study to delineate more specifically the generation of solid waste from mining and processing operations and the costs involved in present disposal practices.

We expect, through such study efforts, to be able to suggest ways to minimize waste disposal environmental problems.

Many of you are aware of the efforts of Bureau scientists at our College Park Metallurgical Research Center who are searching for possible solutions to the problem of disposal of some 125 million tons of municipal refuse generated in the United States each year. Before beginning work on development of salvage methods for this refuse, it was necessary to know the composition of the residues. The immediate task was to establish reliable methods for sampling and analyzing these materials. This problem, which was the initial phase of the College Park project, has now been completed with studies having been made on residues from five incinerators in metropolitan Washington, D.C.

The conclusions of this study were: (1) techniques used in these studies indicate that sampling of incinerator residues can be accomplished on a relatively small scale with good results; (2) glass constitutes the major fraction in all of the samples and averages about 44 percent by weight; (3) relatively large amounts of unburned paper in some residue samples, as much as 12 percent, points up the need for more efficient burning; (4) salvage of all metallic values in the residues, which averages nearly 30 percent by weight, could provide a source of revenue for municipalities and aid in conservation of our natural resources; (5) salvage would also reduce the volume of landfill required for disposal of the balance of the residues by as much as 50 percent. This would double the life expectancy of residue landfill sites and reduce haulage costs by half.

The Bureau is highly optimistic about a process that utilizes steel scrap in an entirely different manner. Chopped-up scrap is heated in a rotary kiln with nonmagnetic taconite — a material that previously has resisted treatment for recovery of its iron content. The iron in both the ore and the scrap is converted to a magnetic iron oxide which can be readily concentrated. At this stage, a conventional iron-oxide pellet can be made containing more than 63 percent iron, or another Bureau technique can be applied to yield a prereduced pellet with an iron content of more than 80 percent. By late 1968 a prototype plant will begin operation near the western end of the Mesabi Range to demonstrate the process. The plant will have a daily capacity of 600 tons of crude ore. A commercial processing plant turning out 5 million tons of high-grade ore concentrates a year would consume 600,000 tons of scrap.

The Solid Waste Disposal Act of 1965 further provides authority for Federal agencies to establish a contract and grant program. Section 204 of the Act permits the Department of the Interior to make grants to and contract with public or private agencies, institutions, and individuals for research, training projects, surveys, and demonstrations relating to solid waste disposal. With very modest funding the Bureau is operating these programs at a level of $600,000 per year.

Study grants totaling $395,000 have been made with the eleven universities. These studies range from the recovery of mineral constituents to how to make plants grow on piles of mill wastes.

Five contracts, amounting to $212,000, have been executed covering research efforts ranging from developing a new technology of recovering fly ash from gases discharged from coal-fired electric power plants to a search for methods of converting red mud residues from aluminum processing into lightweight porous ceramics.

This brief outline should give you an insight into the range of interests the Department of the Interior has developed in solid waste disposal. We have barely scratched the surface. It has taken many generations for the problem of solid waste to reach national importance. It necessarily follows that it will take time and substantially more money to reduce this problem to a tolerable level.

Let me close by emphasizing that solid wastes are a very important factor in our resource base. We must recycle our resources if we are to meet the rising demands for materials as the world population grows and living standards rise. Junk cars are a resource. We must use them constructively.

LEGISLATIVE NEEDS FOR A METROPOLITAN SOLID WASTE DISPOSAL PROGRAM

John J. Bosley *

HISTORICALLY, solid waste collection and disposal in the Washington Metropolitan Area have been carried out by local jurisdictions and private firms. Because disposal of solid waste has been manageable at the local level, the necessity for cooperative endeavors between local governmental units has been minimal. But, in the last few years, the magnitude of the problem has reached crisis proportions in some jurisdictions and is becoming acute in others. Recognizing this, the Council of Governments (COG) in 1965 provided the major portion of local funds for a joint study with the Northern Virginia Regional Planning Commission and the Maryland-National Capital Park and Planning Commission on the metropolitan Washington solid waste disposal problem. A consultant was hired and the report is nearing completion. At this time it would be premature to cite any of the detailed findings and recommendations. It is certain to demonstrate, however, that the problem has metropolitan dimensions requiring the cooperative efforts of the local jurisdictions. In turn, this raises the question of developing an organizational arrangement under which such cooperative efforts could be adminstered. Moreover, the severity of the problem in the District of Columbia already has prompted it to request that COG investigate the feasibility of establishing an organizational entity to administer a regional solid waste disposal program.

Existing Legislative Authority

Federal and state legislation has been enacted which enables local jurisdictions in the Washington Metropolitan Area to enter into cooperative agreements for sewerage disposal and water supply purposes. And, the authorizations in these statutes have been used. For example, the District of Columbia has entered into agreements with numerous local jurisdictions for the treatment of sewerage at its Blue Plains Plant. Ironically, there was a Federal statute enacted in 1930 which authorizes the District to enter into agreements with neighboring jurisdictions for the disposal of their combustible solid waste in the D.C. incinerators. Of course, this is academic; the District's own needs are in excess of the capacity of its existing incinerators.

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Legislative Alternatives

While authorization for cooperative agreements in the functional areas mentioned above have been useful, such arrangements also have limitations. The disposal of solid waste is a good example. As we know, no existing methods of disposing of solid waste are wholly unobtrusive to a community. Local governments attempting to negotiate arrangements to alleviate their individual solid waste problems come under great pressures from local citizens. However, the pressures inherent in such piecemeal negotiations can be substantially reduced if there is a metropolitan plan and program for the disposal of solid waste. Such planning and programming places the problem in a broader context, and, therefore, ameliorates much of the local objections that might ordinarily arise.

But, is there an adequate legislative basis to implement a metropolitan solid waste plan and program? No unequivocal answer can be given to this question. The consultant's recommendations and the degree to which the local jurisdictions accept them for implementation will ultimately determine the nature and scope of any metropolitan solid waste program. And, although definitive legislative formula cannot be proposed at this time, we can make certain assumptions.

Initially, it must be recognized that the metropolitan aspects of the problem cannot be solved by existing legislation. The District of Columbia does not have Congressional authority to enter into agreements with other political jurisdictions for the disposal of its solid waste. Although Virginia has a joint exercise of power statute, it does not apply to jurisdictions outside the State. Maryland has no specific statutory provisions pertaining to extraterritorial solution of its solid waste problems. Under these circumstances, we must look for other mechanisms for dealing with the short range solid waste problems in the metropolitan area.

Such an interim mechanism could be the creation of a nonprofit corporation composed of the local governments of the metropolitan area. This agency could undertake a modest metropolitan solid waste disposal program. Of course, such an approach would be premised on the authority of local governments to enter into contracts with nongovernmental entities for services.

This would only be a temporary solution. The corporation would not have the financial capacity to undertake a substantial program since service charges would be its main source of revenue. This would severely limit its acquisition of capital equipment and its ability to obtain long range financing. Moreover, it would not have the power of eminent domain and therefore could not acquire sufficient areas for landfill or incinerator operations. Nevertheless, this type of entity might provide a stopgap program if the situation warrants.

When substantial capital investment for metropolitan solid waste facilities becomes necessary, consideration will have to be given to legislation creating a metropolitan authority, probably by interstate compact. But, in my opinion, any proposed regional authority should not be established solely to solve the metropolitan solid waste problem. Rather, it should have responsibility for all of the metropolitan environmental health problems. And, we are all aware that solid waste disposal is only one facet of the total waste management problem confronting the metropolitan area. The solution of the solid waste problem must be directly related to the region's efforts to abate air and water pollution and to provide an adequate water supply. Furthermore, any compact legislation could not be enacted without consensus of agreement of the local governments and approval of Congress. Therefore, the structure, functions and powers of such an organization will be subject to debate and controversy. Obtaining a consensus on these questions will require lengthy negotiations. But I believe such complex negotiations could be facilitated by adhering to certain basic principles. Of paramount importance would be the recognition, from the outset, that such an interstate authority would be the joint agency of the local governments in the area. Its governing body should be composed of local elected officials from these governments and not state appointed officials. If it is structured in this manner, it can be the vehicle to implement the policies and plans developed by the local governments through their cooperative efforts in COG. To assure this, the compact authority and COG should have an interlocking directorate or the organizations should be merged. Such an organizational structure would assure to the maximum extent possible, that the agency's programs would be carried out in accordance with the needs and desires of the citizens of the metropolitan area.

As I have already indicated, this would be a delicate and arduous task. But this is the nature of the legislative process. It must embody the desires of the majority and protect the rights of the minority. To a limited extent, this process has already begun. The local elected officials participating in the Council of Governments are aware of and concerned with these environmental problems. The metropolitan solid waste study now underway and COG's preliminary investigations of the institutional requirements for implementation of a metropolitan solid waste program are concrete evidence of their desire to take affirmative action to solve such metropolitan environmental health problems.

OPEN DISCUSSION: PANEL A

Achilles M. Tuchtan, Panel Chairman*

MR. PHILIP B. HALL†: What are the immediate or relatively immediate prospects of solving the problems of scrap automobiles? Is there any thought being given to a regional facility or facilities to solve this very pressing problem?

MR. VOGELY: I'll tackle the first part of the question. The junk car problem is many things to many people. I think that the accumulation of scrap automobiles outside of the industrial stream will be solved over the period of the next few years by either better technologies or by local action in places where the problem is really acute. This will be done in the form that I indicated, that is, making the owner of the car responsible in some way for its disposal into the industrial stream. The handling, however, of scrap cars — the winning of the reusable parts and then the remelting of the scrap body itself — is a process that is industrial in nature and will never be beautiful. What must happen is that it gets confined to areas wherein such industrial processes are acceptable to the population as a whole. Thus, I think the problem will be solved. It will take a combination of technology and local effort. As far as regional compacts are concerned, I cannot address myself to that. Perhaps you can, Mr. Tuchtan.

MR. TUCHTAN: Well, I have a comment here from Dr. Jack Lentz who is on the staff of the Washington Council of Governments. He says, "Shredding and incineration plant in the planning stage in Baltimore reported to be able to handle 2,500 cars a day." and COG's Regional Sanitary Advisory Board is investigating this and other techniques with the objective of adding to the best possible technology, the political mechanism to provide a region-wide approach. We are now in the studying stages.

MR. VOGELY: Yes, most of the scrap cars from Washington now flow to Baltimore, and if you improve the scrap processing facilities there you provide an outlet. This still doesn't solve the problem of the car that's abandoned on private property that never gets into the industrial stream.

MR. TUCHTAN: That is true. I know that in the jurisdiction from which I come — the city of Rockville — we have an ordinance regarding

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† Philip B. Hall, Public Works, Alexandria, Virginia.

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this problem. We have made it very clear, for example, to our citizens that we will remove gladly all vehicles that are abandoned on their property. It costs us, but from the health welfare and sanitation points of view, we want to do it, and have so advised them in a newsletter. That doesn't mean we're inviting everybody here to come out and leave junk cars on our city streets or lots.

ANONYMOUS: Does GSA refer to the method of solid waste disposal in solid waste collection contracts?

MR. EASTMAN: I believe that question is directed at the end act of disposal of the material that is collected by any contractor. If that is the intended question, we do not speak to the method in which solid wastes are disposed. Presumably, any contracting firm licensed to collect waste material must have a satisfactory means of disposing of that material. Possibly it's not satisfactory in light of the present acts of today. Maybe it's using Kenilworth Dump. But we do not speak in our contracts to the method of disposing those materials that are collected by contracting companies.

MR. PHILIP B. WISMAN*: Have you considered the alternative to landfills and incineration namely the recently perfected commercial composting method sponsored by waste conversion science foundation? They have units to handle 500 tons per day. This involves no landfills, no air pollution. Why not look into it, especially in view of the impending world shortage of fertilizer?

MR. BREMSER: Let me say 'yes.' We have looked into this, and as a small-scale operation, it's quite feasible. But to compost the refuse produced by upwards of 2 million people creates a very large marketing problem with what you do with a compost once you have it.

MR. ALEX F. PERGE†: Is there a rule of thumb figure for landfill needs per population unit, such as acre-feet per 10,000 people?

MR. H. LANIER HICKMAN, JR.‡: One acre per 10,000 population per year per 8-foot layer of fill. Has anyone considered a separate collection, say once a month of only newspapers for possible reuse?

MR. EASTMAN: I commented on that with respect to the collection of saleable paper. The government does segregate paper that is resaleable and that would be bond paper, letter paper; there would be paper that is scrap from printing processes, high-grade paper; it would be IBM cards used in the numerous data processing centers that are no longer required. These are all collected, segregated, filled, and sold to paper people for reuse purposes. I don't know whether that goes far enough to answer the question.

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‡ H. Lanier Hickman, Jr., U.S. Public Health Service, Cincinnati.

Mr. Tuchtan: Rockville has a program whereby all of our refuse is picked up in the backyard. We find that our citizens don't like to carry their garbage cans to the curb. We do not tell them what to put in those cans. They put anything of a refuse nature that goes into a garbage can. However, we do have a once a month repickup of anything they cannot dispose of. And that includes refrigerators, washing machines, springs, and mattresses, and what have you. And it's a service that the city renders to its citizens I would say that if our community — the one I live in — is any example, if you were to ask the citizens to segregate and separate out their refuse, we would have a rough time on our hands. I wouldn't be standing here; I wouldn't be elected I can assure you. So, I think this is one of the problems we would have to consider, it's perhaps of a political nature, but people don't want to be pinned down to sorting their refuse.

Francis A. Govan*: "Good incinerator sites are hard to find today and should be bought quickly." That's a quote of yours. Does the site selection criteria require the possibility of heat conversion plans as used in Europe and proposed in the U.S.A.?

Mr. Bremser: Not necessarily, the criteria for incinerator sites are basically that they be in a neighborhood where they're not offensive. This means generally a heavy industrial type neighborhood with access by highways, and streets in which heavy truck traffic is not offensive. These considerations are the most important issues. But a location where steam may be sold certainly should be a consideration.

Mrs. E. Jones†: Is another interstate joint agency necessary to administer solid waste disposal? Isn't COG set up to function in this area now?

Mr. Bosley: The determination of whether you would need additional institutional arrangements for implementation of programs for solid waste disposal largely will be determined by the type of regional program that is agreed upon. Certainly if the program is right to require large capital investment and the power of eminent domain, a metropolitan agency having a legislative basis will be required. This does not, in any way, indicate that the organization must be another special-purpose agency. If we have to consider a formal interstate organizationual arrangement. I believe that this region has reached the point where it must consider not only the solid waste disposal problem, but the other Metropolitan area problems that might in the future require some sort of organizational arrangement to effectively solve them. What I am really saying is that if we have to go to an organizational structure, let's go to the optimum one. Develop one that is going to reflect the needs of the region. We should establish an organizational structure complementary and supplementary to the local government activity in the region, not one which would compete with the local government. These are the decisions that we must consider in the next several months. It would be premature at this time to say that we must have an interstate compact agency because we just don't know: we don't know definitely what can be agreed upon to solve metropolitan-wide programs such as solid waste disposal. And until that is determined, we will not be able to establish any criteria or suggestions with regard to organizational structure for the carrying out of such programs.

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† Elizabeth Jones, League of Women Voters of the United States, Washington, D.C.

ANONYMOUS: . . . Can the District of Columbia participate?

MR. BOSLEY: Well, there is some precedence for this. In 1958 and '59, there was a joint committee of the Congress, House and Senate, that studied Metropolitan affairs and problems in the Washington Area. Portions of recommendations of this committee, were enacted into law. One of the recommendations established was the Washington Metropolitan Regional Development Act. This legislation states that it is the policy of the United States Congress to encourage the District of Columbia and Federal departments and agencies to act in concert and to work together with the local governments in the Metropolitan area for unified solutions to those problems which are regional in scope. Further, it sets forth certain priorities that should be considered. Among priority items delineated is the solid and liquid waste disposal problem. The second recommendation of the joint committee concerned the development of a rapid rail transit authority for this region. Of course, this has come to fruition with the establishment of the Washington Metropolitan Area Transit Authority. The legislative authority to establish this agency — The National Capital Transportation Act of 1960 admonished that in negotiation of the compact other metropolitan problems requiring a unified approach to their solution should be studied. This was a recognition in effect, of the need for the District to participate in an organization having more than transit powers. I think it is significant here to indicate that the Washington Metropolitan Area Transit Compact (WMATA) also sets a precedent that justifies some of the suggestions that

I've made here today. For example, Congress permitted deviation from the normal compact organizational structure. The governing body of WMATA is not composed of individuals appointed by the governors of the States. Instead, the compact recognizes that the decision making process for this metropolitan region should incorporate the people that live within this area. Therefore, the compact specifically provides for the participation of the District Commissioners and the locally elected officials from Virginia and Maryland are its governing body. Consequently, there is ample precedence for the District's participation.

The more important questions really concern the type of structure which might be suggested and what its duties, powers, and responsibilities would be. Naturally there is bound to be a great deal of debate and dialogue on this issue. But I think that there's no doubt that back in 1960 Congress envisioned that there would be conditions requiring the District to participate in a joint agency with other local governments in this area to solve metropolitan problems.

Mr. Michaels: Do you have information on the cost of installing air pollution controls in existing office building incinerators?

Mr. Eastman: I do not have offhand, but I mentioned the fact that 18 of our incinerators have been surveyed to ascertain what corrective measures must be taken. Generally the measure will consist of water scrubbers. I do not recall what this will cost to accomplish. I have that information in the office. I do not have it readily at hand here.

Mr. Tuchtan: I believe that your study on this, too, Mr. Eastman, is in connection with the District of Columbia's efforts to pass an air pollution control ordinance.

Mr. Eastman: That is correct.

Mr. Tuchtan: We have two jurisdictions in this area which have had ordinances. The District is working on it, and seven others are now in the developing stage. So of the 15 participating jurisdictions in the Council of Governments we hope that certainly by the start of the next year we will have standardized our air pollution control ordinances in the region and have a region-wide program in effect.

Mrs. E. Jones: In your opinion, is the air pollution bill passed by the Senate yesterday sufficiently comprehensive and enforceable to have real and or immediate impact nationally? Is the House favorably disposed towards its passing?

Mr. Middleton: The Senate action represents a significant step forward, adopting, in essence, the Administration proposal on the Air Quality Act of 1967. I'm hopeful that passage in the House will allow us to proceed further in cleaning up the air in the United States.

Mr. Frederick A. Moran*: He's from Baltimore, and this is concerning burning stumps as "the cheapest method of disposal of stumps is burning" according to Mr. Bremser. This creates a spirit of mutual harassment between land developers and residential neighbors. If open burning were more closely controlled, what is the speaker's opinion of the ready use of other than the 'cheapest method,' i.e. mobile mechanical cutters and so on?

Mr. Binnewies: I'm not sure I quite understand . . . I think that the emphasis of the question is why not the use of mobile mechanical cutters rather than the burning of stumps as the cheapest method of disposal. Did I interpret the question correctly? . . . We do use cutters quite a bit. The thing that I referred to particularly was the disposal of stumps from the Dutch Elm disease. We just about have to do this by burning, because if you distribute the wood by chipping or anyway like that, there's a very high danger of infecting other trees. In other cases of stump disposal, you can use chippers. As a matter of economics, it takes a while to chip up a stump; they're full of cross-grain, you know, and not very easy to get rid of, but it can be done. It takes longer than just to haul them out to a dump and throw them on a pile and eventually burn them up. They are usually not suitable for campground wood; the difficulty in splitting generally makes them not desirable. Stumps are probably the toughest part of the tree to dispose of.

From the Floor: I wonder whether one of the panel would address himself to the problems of disposal of demolition debris.

Mr. Eastman: I can only refer very briefly to this type of material as far as our program is concerned. I will allude to that accumulation of debris resulting from construction of our own forces which would constitute such items as plaster, wallboard, bricks, mortar, etc. This is the type of debris that we collect and then must contract with some contracting company to dispose of. Presumably this same contracting firm has some permit for disposing of these unburnable items in a suitable sanitary landfill area. With respect to major demolition, we let a contract whereby a wrecking company agrees to demolish and dispose of any of the demolished items he accumulates through that process.

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* Frederick A. Moran, Maryland Department of Health, Baltimore, Maryland.

Again, our contracts do not speak to how a contractor will dispose of these materials. Maybe, this is something that we should speak to in terms of the overall problem. However, it has not been our practice within the demolition contract to specify the ultimate method of disposing of those materials.

Mr. Bremser: The normal practice, of course, is to take the demolition material which consists of lumber and broken concrete, brick, glass, and everything else generally knocked down by a headache ball and pushed over by a bulldozer and load it onto a truck and dump it somewhere. It's not a practical matter from the demolition contractor's point of view to try to separate the materials. If the material is from, say, a frame house and basically combustible, there is no reason why if you had a large-scale shredding installation, you could not put this material through a shredder and burn it in a normal incineration plant. Barring this, about the only thing to do with it is to burn it in the open. You may know that in Detroit, they have built some incinerators within the last few years specifically for the purpose of burning brush and tree debris and this sort of thing. There's no reason why this type of incinerator which provides a long retention time could not be used to handle basically combustible demolition debris.

Mr. Tuchtan: The Council of Government's model air pollution ordinance has a provision pertinent to demolition debris. I think the City of Rockville and Montgomery County employ this provision for construction of new structures. For example in housing areas where a developer comes in and builds a number of homes, open burning is a permitted but controlled practice. Scrap lumber and stumps can be burned on site. The control is applied to the kind of fire. For example there is the direct prohibition to the use of tires as a source of heat. An open burning permit is required.

We must also recognize that we cannot stand in the way of certain normal business or construction practices which in themselves do not create an air pollution problem of any magnitude. So we should permit business to be able to operate in those instances, such as construction where open burning can be undertaken without any material increase in air pollution.

The problem in air pollution is to tackle it at the greatest source, and the burning of stumps is a very minor one.

Mr. G. Derrickson*: This is on the subject of junk and abandoned motor vehicle problems. I should like to supplement Dr. Vogely's statement by calling the attention of this conference to the publication of two valuable reports in this area by the Business and Defense Services Administration, U.S. Department of Commerce as follows:

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* Gardiner Derrickson, U.S. Department of Commerce, Washington, D.C.

1. *Iron and steel scrap, consumption problems.* Business and Defense Services Administration. U. S. Dept. of Commerce, Washington, D.C., 1966, 52 p.
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Panel B: Technology Today

TRANSPORTATION SYSTEMS

Robert D. Bugher *

WASTE DISPOSAL has been with man throughout his history. Every human existence produces waste and man's attitude throughout the ages has been: (a) to get away from it as far as possible, "to take it down the road," or (b) to change it into forms which are not objectionable.

Thus waste disposal involves both transformation and transport of refuse.

The subject of this presentation concerning the utilization of transport systems deals only with one of the two very basic approaches to waste disposal. Waste transformation processes are discussed in other papers concerning waste reduction, incineration, composting and waste recycling opportunities. It must be recognized, however, that waste handling and disposal technologies are intimately related and that transportation is a key element of virtually all waste removal systems. Thus, to establish a framework for this presentation, it might be stated that efficient waste removal requires a tailor-made integration of both: (a) the waste collection and disposal efforts, and (b) the transportation system.

One cannot talk about a transportation system for solid wastes without consideration of the happenings at the point-of-waste origin. Both the type and quantities of waste are of concern. On-site reduction of solid wastes through home incineration, grinding, or pulping and salvage might reduce the quantities drastically.

Furthermore, the transportation system actually begins at the point of the waste origin. The waste originator is already part of the system if he must bring his garbage can to the curbside at a given time which corresponds to the collection schedules. Costs increase drastically — up to 50 percent in time per pickup stop, if the collection crews must get the cans from backyard storing places or out of garages. To reduce the handling and transportation costs at the point of origin it has become advantageous for some locations to use disposable paper sacks instead of the metal or plastic garbage can. Paper sacks are light weight, necessitate only a one way pickup trip, prevent the wastes from being blown around by high winds, reduce noise, and provide for an improvment in sanitary procedures. Paper sacks currently are sold at about 8 to 12 cents each with about a 3.5 cubic foot capacity. Some European countries, including Sweden, Denmark and Great Britain have begun to experiment with compression devices particularly in apartment buildings to increase the quantity of refuse that is fed into the sacks.

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On the other hand, disposal efforts are of equal importance for the establishment of tailor-made transportation systems. Acceptable incineration placed in strategic locations will reduce or eliminate long distance hauling; effective composting, in turn, might require long distance hauling to be beneficial to areas where the basic soil needs improvement before fertilizers can be used with maximum advantage. In looking at waste disposal systems and their transportation elements it must be recognized that relative insufficiencies in one building block of the system may be more than offset through advantages gained by other considerations.

Historically, all means of transportation have been used for the removal of man's waste. At one time people carried the wastes or used slaves to remove it from the immediate environment. Waste also has been transported on horse back, by horse and wagon, by ship, by rail, by car and by truck. Improvements in transportation technology usually led to an improvement in the waste handling methods. The size of waste collection trucks, for example, has increased from 9 cubic yards in the 1920's or 1930's to up to 50-cubic-yard vehicles experimented with today which are equipped to empty and load heavy containers automatically.

It is estimated that currently about 40,000 vehicles are used exclusively in the United States for the collection of solid wastes. These vehicles represent an investment value of about $400 million. Refuse collection trucks, varying in size from 10 to 30 cubic yards can cost anywhere from $10,000 to $30,000 per unit. In addition, equipment storage and maintenance facilities amount to about 12 percent or $48 million of the mobile equipment value according to a recent APWA survey.

There are several different types of collection trucks in use at the present time. The increase in the quantity of paper wastes and the decrease in ashes has resulted in a high-volume low-density refuse which lends itself readily to compaction. Rubbish may be as light as 200 lbs per cubic yard while garbage or ashes may weigh more than 1,000 lbs a cubic yard. The 18-cubic-yard to 20-cubic-yard capacity vehicles are the most popular ones today. There are several different types of compaction trucks in use including: (a) rear loading hopper type bodies which use either a single blade or a flight conveyor for sweeping refuse into the body; (b) a side loading unit in a rectangular or cylindrical body which uses a movable hydraulic bulkhead for both compaction and ejection; and, (c) a special container collection vehicle which is a top loading unit which uses the movable bulkhead for compaction and ejection.

The cost per ton of refuse collected varies, of course, considerably, depending upon local wage rates, equipment cost, collection policies, the spatial distribution of pickups and the respective refuse amounts, traffic density on streets used by the collection trucks and the route and haul distances. Costs per ton of refuse are quoted from $3.90 to about $14.00 for normal combined refuse excluding bulk objects.

Unfortunately, waste disposal has always been saddled with considerable socio economic burdens. Being at best a nuisance, waste disposal had to make do with absolute minimum amounts of money, manpower, and equipment. As a result waste disposal frequently has been and in some instances is still handled in a rather pedestrian manner.

Solid waste disposal in the United States today is estimated to represent a $3-billion industry with about 70 to 75 percent of that amount spent on waste transport alone. Furthermore, the total production of solid wastes calculated on a per capita basis has grown from 2 lbs per capita per day in the 1920's to more than 4 lbs per capita per day today. It is estimated to grow at an annual rate of about 4 percent. It appears already safe to say that in the near future, on the average, nearly 1 ton of solid wastes per person per year must be collected and disposed of. Also, while our environment once was capable of absorbing and digesting all of man's wastes, it is no longer able to do so. Environmental pollution has become a major threat to all urbanized settlements. Yet the task and challenge of waste disposal still will continue to grow.

The population of the United States is expected to double by the year 2000. It is forecast that much of this explosive growth will take place in urbanized areas, such as Washington, D.C. Coupled with an increase in industrial and commercial activities as well as the direct per capita consumption, such growth will result in [illegible]gering problems for solid waste disposal and management. Considering the amounts of solid wastes involved plus the spatial concentration of the waste generation, it becomes obvious that solid waste management involves most operating factors generally found in mass production, mass transportation and mass service. This "mass" aspect of waste removal activities requires that well and thoroughly developed system approaches be used to handle the removal in an adequate, efficient and economical manner.

To set then the stage for an analysis of transportation systems with respect to waste removal, one has to recognize that waste by definition has no economic value. This suggests that high-tonnage low-cost transportation carriers be utilized as much as possible. Constant cost reduction must be made the only objective for progressive waste management, if mere disposal and not utilization is the primary waste management goal.

Furthermore, all currently known waste disposal methods ultimately require land for a disposal ground. But in urban areas land is in short supply and in demand for more attractive and productive uses. In turn, waste has to be shipped out of such areas over ever-increasing distances and, consequently, bulk transportation facilities become more and more important as the backbone of waste removal efforts.

What then are the basic elements of transportation systems that must be considered in waste removal applications?

In a nutshell, and this is important, transportation can be highlighted as a material- or people-handling system. In this presentation, of course, we deal only with the movement of materials, although materials are and can be moved over pure "people" transportation systems such as local transit lines.

A transportation system can be described as a method of movement by which things "flow" through a system. In terms of movement, things may be handled: (a) horizontally, by such means as trucks, trains or barges; (b) vertically, by elevators or chutes, and, (c) vertically as well as horizontally, by helicopters, conveyors, and pipelines operated either hydraulically or pneumatically.

The actual movement of things is constrained by the physical facilities of a transport system, i.e., the channels of the network. The physical facilities, in turn, may be grouped into the fixed installations of the network, e.g., railroad tracks, roads, and river channels, and the mobile equipment. Thus the available transportation capabilities determine, to a large degree, what kind of transport system can be used in handling the wastes for a given area.

Not all transportation systems, of course, have mobile equipment as such. Pipelines and conveyors as a rule do not have "vehicles," and there is a direct interface between the materials being moved and the fixed system installations. On the other hand, in transportation systems having mobile equipment, the vehicles might be considered containers which provide the interface between the items transported and the fixed installations. The kind of transportation vehicles that are available carries considerable systemic implications. The "vehicles" available determine, for example, whether wastes ought to be liquified, baled, containerized and/or reduced in size in order to obtain maximum system benefits.

The interface structure of a transportation system is of utmost importance in determining the suitability of a given system for waste removal purposes. Whether, for example, industrial, commercial and special wastes such as hospital wastes can be included. Commonly, refuse transportation requires a system to handle a wide variety of materials of all sizes, capable, to various degrees, of "contaminating" the environment. Public health and sanitation aspects must therefore be of overriding concern.

The transportation network itself may be viewed in a building block fashion. It consists of links and transfer points. A link corresponds to a specific transportation channel and may be well defined as, for example, in the case of a rail line or highway. Links of the same, similar, or different modes of transportation may cross each other as, for example, by a railroad crossing or a bridge, or they may provide an interchange as, for example, in a road junction, airline terminal or railroad switching yard. Considering transportation as a building block system, it becomes obvious that the waste management system planner must evaluate many transport alternatives to develop an approach which is tailor-made for a given area.

Ultimately, of course, links to transfer stations where the materials are moved on or off a given transport network. Such a transfer might involve either a change from one mode of transport to another, for example, from trucks to rails or the original loading and final unloading operations. The transfer of materials frequently represents a major share of the total direct operating cost of transportation systems.

Finally, the path of materials being moved through one or more transportation networks might involve a succession of links and transfer stations. In this way networks and/or vehicles interact over space and time, and the selection of an optimum total transportation system might require a considerable amount of network balancing. Factors, such as the following, typically are involved: total trip time, reliability of service, time and effort spent at transfer points, safety considerations, direct operating costs and indirect expenditures such as insurance, interest and storage and impact on the environment and its inhabitants.

Thus, in analyzing existing and potential transportation systems for refuse removal applications, one must consider: the types and amounts of the materials to be transported; the feasibility of transforming the wastes to facilitate transport, and the point of storage and collection; the vehicles and or ways in which the materials are conveyed; the networks through which the materials move; the number and type of transfer stations needed; the public health, sanitation and safety requirements; and, of course, the time and cost charges.

In dimensioning the waste material handling or transportation system for a given area, it is necessary to make, first, some basic decisions concerning the local refuse removal policies. Questions such as the following must be answered *a priori*:

(1) How large is the area to be served by the system? Are we concerned with only Washington, D.C., proper, which had a population of 764,000 people in 1960 (according to the U.S. Census)? Or is the system to serve the Washington Standard Metropolitan Statistical Area, which had a population of more than two million at the time indicated and was growing at a rate of 36.7 percent per Census decade?

(2) Should the refuse removal system handle all the wastes generated including residential, commercial, industrial and special wastes, or should it deal only with selected categories of refuse such as the residential municipal wastes?

The composition of residential wastes alone — those generated by the householder — already provides considerable transportation problems. Excluding abandoned automobiles, for example, Washington trucks annually have to remove about 6,700 bulky metal objects such as refrigerators, washing machines, bed springs and oil drums. It is estimated that appliance dealers and private collectors haul an equal quantity of such objects to the disposal sites. In addition, there are putrescible materials, paper, glass bottles, aerosol cans, paint containers, tires, rags, and, of course, automobiles.

Furthermore, the District of Columbia ranks among the major industrial commercial centers in the United States. In 1965 it had almost 17,900 commercial industrial establishments covered by the Federal Insurance Contribution Act. This means at least one and probably several pick-ups from each of such establishments every week. These provide employment for almost 305,000 persons. Major business groups in the District produce a variety of waste materials and in 1965 included the following:

TABLE I

BUSINESS GROUPS IN THE DISTRICT PRODUCING WASTE MATERIALS

Business group	Number of employees	Reporting units
Total	304,941	17,879
General construction (demolition wastes)	26,262	1,015
Manufacturing	23,495	689
Food and kindred products (garbage)	4,559	54
Printing and publishing (paper)	13,861	343
Wholesale trade	21,848	1,334
Retail trade	65,839	3,850
Eating and drinking places (garbage)	18,938	1,002
Services (paper, garbage and medical wastes)	104,483	7,038
Hotels and other lodgings	10,810	253
Misc. business services	15,311	849
Medical and other health services	11,539	1,241

It must be remembered in this context, that types of employment not covered by the Social Security Program are not included in the above data. Thus, government employees, self-employed persons, farm workers, and domestic service workers are not covered in the foregoing tabulation.

Finally, the amounts of wastes to be handled through a transportation system depend also upon the waste disposal practices utilized or required at the point of waste origin. Grinding transfers the wastes into the sewer system and home incineration reduces the volume and the frequency with which wastes have to be picked up.

(3) The third set of questions addresses itself to the spatial distribution of waste generating units. A high concentration of such units as, for example, in high-rise buildings or large city apartment blocks, might suggest the establishment of vacuum, chute, or similar collection and transport systems. One-family housing settlement patterns, on the other hand, probably require that the collection and at least part of the total transport be handled by truck. Data from the 1960 Census of Population and Housing indicate wide spread density patterns for Washington, D.C. proper on a Census Tract basis. Correspondingly, they suggest some significant spatial differences in residential waste generation. Data for selected census tract settlements range as follows:

Number of rooms per housing unit: 1.2 to 7.5 rooms

Number of persons per housing unit: 1.1 to 4.1

Median family income: $2,912 to $19,815

Consequently, the intracity waste handling and transportation requirements might vary considerably if a system is to be devised which serves all areas on a tailor-made and highly desirable basis. High density areas, for example, might suggest the application of an integrated container system starting at the point of waste origin while low density areas might continue to do with the common garbage can or disposable paper or plastic sack. Industry has developed various types of waste collection and transport equipment to meet the requirements of different urban settlement patterns.

(4) The fourth set of questions, of course, must deal with the area's existing and the potentially available total transportation systems. The Washington transportation system reflects the fact that the District of Columbia is the seat of the Federal government.

The Washington, D.C., area is traversed by three railroads and the Potomac River. In addition, there are many highways leading in and out of the area. A 25-mile subway system costing some $431 million is planned for the metropolitan area. It is conceivable that it could be used during the night-time hours as part of a waste transportation system. The existing incinerators and landfills might also provide readymade locations for transfer stations.

The existing mass transportation system of railroads and rivers serving the Capital connects the area effectively with the outlying regions in which the ultimate disposal of wastes might take place. This could conceivably be accomplished on a long-range basis by all-round desirable and advantageous methods. The present Washington transportation system, with its highways, railroads and the Potomac River, thus allows the waste removal planner a wide range of alternatives for system development in terms of both the mode of transportation and the ultimate destination. This view is based on the belief that: (a) wastes can ultimately be disposed of in an unobjectionable manner; (b) wastes can often be used to increase the value of marginal land; and, (c) since there is widespread public opposition and fear to the mere thought of living near a waste disposal facility -- as if it were an ammunition dump -- they should be located as far away from high-density population centers as is economically feasible.

(5) The fifth and final set of major questions concerns the system participants. It must determine who is to operate which part of the system, who is responsible in what way for total system performance, how the burden of

cost is to be distributed, who might provide the waste inputs, for example, private collectors, municipal forces, and/or self-disposers such as a private citizen coming with his station wagon and a can of grass clippings on a Sunday afternoon. Last but not least, it must be determined how the wastes must be delivered to conform to specific system requirements, for example: should the wastes be packaged, baled, or pre-containerized. Should they be put in paper sacks or metal and/or plastic cans, etc.? This involves the regulation of human behavior so the system can function with a reasonable degree of efficiency.

It is obvious that answers to the above questions and subquestions do have considerable systematic implications regardless of what transport and material handling system one uses.

It is also obvious that the selection and development of any system will materially affect the livability of any given area. Every community represents, however imperfectly, a system for living and simultaneously an engineering system. Only the interaction of both systems make the parameters of community life and growth.

Furthermore, it is obvious from the presentation thus far that refuse-removal-material handling and/or transport systems are very complex and have numerous ramifications. The transport system begins with the on-site storage of wastes at the point of origin. The refuse originator is part of the transportation system if he has to bring his garbage can to the curbside at a predetermined time.

In view of the many system elements and the potentially large number of system performance factors, it is impossible for me to cover the subject in great detail. Time limitations suggest that this presentation's primary purpose is to discuss the subject in terms of current knowledge and suggest promising areas for imaginative research. Only system development work, including techno-economic and socio-economic as well as management analyses, will produce results which will make this area's waste removal a showcase for the nation and for the world as well.

In looking, then, at specific transportation systems with respect to waste removal operations, it must be recognized that basically three system development approaches are involved: (a) The transfer of existing technologies "as is" into the waste removal field. Such technologies might come from other fields of commercial industrial endeavor or the vast U.S. Government research and development efforts including, in particular, Public Health, NASA, and Department of Defense projects; (b) The development of these technologies in terms of specifically tailor-made waste removal applications; and, (c) The long-term development of perhaps completely new technologies which would turn the current nuisance of wastes into a useful national resource. It does no harm to apply visionary thinking and objectives to a mundane problem such as refuse removal. We must have the courage to direct the promise of research wholeheartedly toward the solution of our everyday problems, and we also must have the stamina to back up our courage through generous action. It is a sorry situation and a poor reflection on our sense of values that we stand on the threshold of putting a man on the moon but still handle the wastes we produce using methods developed during the horse-and-buggy era. The state-of-the-art has not yet advanced to the point where it can be regarded as a sophisticated waste disposal management science. But with the impact of the Solid Wastes Program things have begun to move and significant progress is being made to employ the opportunities modern science and technology do offer. The success of research in other areas, given only firm and urgent objectives, most certainly justifies any conviction or hope we might dare to have.

Specific existing material handling and transportation system can, of course, cover a potentially wide area and only some selected highlights can be given here.

There are pipelines, for example, and piping systems could, considering the community as an engineering system, originate right in the housewife's kitchen. Existing technology in the field is highly developed. Even solids in the state of slurries are moved with success. However, initial capital costs are high and efforts toward the acquisition of right-of-ways may be frustrating. On the other hand, operating costs are quite low, amounting to roughly pennies per ton mile for all kinds of materials moved.

Piping systems can be operated pneumatically or hydraulically. The Federal government, through the Public Health Service Solid Waste Program, currently is sponsoring research which considers a water/sewage borne system and a 30 to 40 percent solid slurry for center city applications and a pneumatic system for the outskirts of settlements. The systems, of course, must operate under pressure since refuse loading changes water and sewage into a very complex fluid. In principle, materials can be piped over unlimited distances and it has to be determined where economics require cutoff points.

Pipelines are used or considered for all kinds of materials which are transported in large volumes. Coal, for example, is moved 110 miles by pipe into the Cleveland area. Today, there are about 20 phosphate rock pipelines in the U.S. handling over 30 million tons of rock per year. These lines are 14 to 16 inches in diameter and range in length up to 5 miles. Solids lines have also been built to move gilsonite, limestone and borax. According to present technology, however, it is required that the solids do not undergo any undesirable change, including flow characteristics, as a result of the mixing of the solids and liquids or of the transportation process itself.

Pneumatic systems have been tested in Sweden. A system has been recently established in a large housing project which will ultimately include 2,600 dwellings. This system moves refuse, by suction, at a speed of about 90 feet per second in pipes of about 2 feet in diameter. The vacuum in the system is created by electrically-driven turbines. It moves the refuse from selected system channels at predetermined times and one vacuum unit thus can serve a great number of channels depending, of course, upon the rate of channel loading. Pipe systems extending a distance of up to about 2,500 yards are currently visualized. This concept is currently being considered for installation in a large housing project in Westminster, England. The capital cost per flat (apartment unit) is calculated to run about $310, while the annual operating costs are estimated to range from $12 to $15 per unit.

The advantages of pipe systems for local collection activity are numerous despite the heavy original investment requirements. Pipe systems require little labor, they can move the wastes to storage areas which are conveniently accessible through a 24-hour day including weekends, and there is no spillage, smell or noise. Although pipe systems may not be economical today if compared with other more conventional collection systems, the picture may change in the near future as refuse quantities and collection cost continue to increase. In waste disposal transportation systems we deal with service life spans of 5 to 8 years for refuse trucks and 20 to 30 years for incinerators.

I might also point out, in passing, that other factors besides cost alone should be considered in determining the type of waste disposal system that would serve the best interests of the community. For example, the pneumatic pipes referred to above could conceivably be installed in utiladors which would contain water mains, electric power lines, telephone lines, sewers and drains as well as postal tubes. They could be designed for easy access by covering them with prefabricated slabs which could serve as sidewalks. This would eliminate the need to inconvenience the motorist by noisy road opening operations when it becomes necessary to repair utility lines and also eliminate the garbage container and the noisy refuse collection operations. This concept, it seems to me, should be tried out at an early date in a high density urban area under the Model Cities Act.

Another means of moving wastes from high density and highly congested areas may be cargo helicopters. Helicopters capable of conveying payloads of several tons are available. Their operating costs range around $3 to $5 per aircraft per mile depending, of course, upon the total amount of miles flown. Cost per ton per mile may amount to only $1.50 to $2.00 and perhaps even less, if helicopter advances developed for use in Viet Nam reach the civilian market. Helicopter transport already is employed successfully and profitably for industrial applications in the building of power transmission lines.

However, the purchase price of helicopters is rather high. Many helicopters are still made to order. Helicopters which are most commonly used by the Marine Corps in Viet Nam and by the Viet Air Corps cost about $225,000 per unit in civilian markets. By contrast, crane-type helicopters which are not yet commercially available and which are capable of carrying 50 people or a 10-ton payload may cost up to $2 million per unit. Twin-turbine helicopters capable of flying 25 people and already in commercial use cost about $690,000 to $800,000.

Thus, helicopters may be utilized in only specific operating conditions where, for example, traffic density and congestion does not permit the operation of collection vehicles at an acceptable pick-up and transport performance level.

The long-distance transportation of bulk materials is primarily the domain of railroads and barges. Comparing in turn the spatial service restraints of barges and railroads one finds that railroads are more ubiquitous. Thus railroads offer more options in terms of both the communities and people to be served directly and the selection of diverse disposal sites. Railroads are also capable of moving large tonnages, generally up to 150 tons per vehicle, and thousands of tons per train, at high speeds. However, the District is situated along the Anacostia and Potomac rivers. Depending upon land reclamation opportunities along the river or the advancement of ocean disposal techniques, barges might provide waste removal service, perhaps for a selected part of the materials such as demolition wastes.

To give an order of magnitude for the ton-mile cost of barging, it may be stated that depending upon the number of barges being towed, speed, upstream or downstream transport of wastes, the ton-mile cost may range from $0.005 to $0.025.

Barges cost about $90 per ton of carrying capacity. The most commonly used barge is about 195 feet long and 35 feet wide and has about a 3-foot draft. However, there are also jumbo barges which are considered most efficient for large-scale operations because they have a carrying capacity from 1,000 to 1,500 tons. In evaluating barge cost as well as highway and air transport cost, one must recognize of course, that a significant share of the actual transportation cost is borne by the national investment in each form of transportation.

Railroads, of course, have a varied experience in the mass transport of materials and the corresponding loading and unloading of cars. Goods are handled through roll-on roll-off, lift-on lift-off containers through unitizing or the stacking of containers, through gravity loading or unloading, and through hydraulic or pneumatic pressure. Railroads are characterized by a high fixed investment in trackage while the rolling stock needed for the handling of refuse might be relatively inexpensive. A covered hopper car capable of carrying a payload of about 80 tons costs about $25,000. Rail transportation costs depend, of course, to a large degree, upon the tonnage hauled. Recent proposals made for the hauling of refuse over a distance of 80 to 100 miles quote a rail rate of $2.75 per ton at the rate of 1,000 tons per day and $2.15 at 3,000 tons per day. The latter is based on the use of three transfer stations, but excludes the transfer and disposal costs.

Transfer stations appear to be the key to the "long-distance" transport of refuse since the loading operations start the long-distance section of a transport system. Transfer stations can be designed as stationery or mobil units and they might utilize a variety of material handling techniques such as conveyors, presses and rams, pumps, air power systems, vibrators, containers including the corresponding loading and unloading devices, the air-cushion handling of unitized loads, automated storage and retrieval of containers including dockside prepositioning devices and the necessary instrumentation such as weighing and identification devices to aid management in running the system at peak efficiency. Depending upon the equipment used and the amount of refuse to be handled transfer stations may require investments from $80,000 up to $1 million excluding land cost. Operating cost, of course, vary with the volume. A recent railroad proposal estimated the transfer station cost at $0.42 per ton at a handling volume of 500 tons daily and at $0.22 per ton at a 1,500-ton daily volume.

Finally, almost everyone is familiar with the U.S. truck and trailer systems. The existing state of technology offers vehicles capable of carrying 120,000-lb payloads. But few states permit these 60-ton payload rigs on their roads, and highways designed to carry heavier loads will be required if greater loads are to be carried by this mode of transportation.

Gross operating cost per vehicle mile for gasoline and diesel engine powered trailer combinations range from about $0.35 at a loaded gross weight of about 22,000 pounds to about $0.65 at 120,000 pounds and $0.90 at 180,000 pounds. The average payload for a 22,000-pound trailer combination is about 7 tons; for 120,000 pounds loaded gross weight, about 40 tons; and for 180,000 pounds, about 60 tons. The cost per ton-mile for freight-hauling trailer combinations, traveling at a minimum average speed of 50 mph, range from about $0.05 to about $0.015 if the trailers are fully loaded. Trailer combinations, of course, are a means for long distance hauling and total transport system cost must include the transfer station cost as well as the local collection cost. The transportation cost, excluding depreciation of equipment, of a typical 18- to 22-cubic-yard packer truck carrying from 3 to 4 tons of compacted refuse, is estimated at $0.35 to $0.40 per mile.

The available basic means of transportation offer a large number of application alternatives for refuse material handling and transport systems. Local waste piping systems, for example, might be integrated with railroad tank cars. Helicopters may be used in conjunction with railroad or highway vehicles. Each system, of course, can be operated independent of the other. The coordinated management of transportation systems might lead to salvage opportunities which will not exist if wastes continue to be handled by a multiplicity of small-scale operations.

In the end, of course, every solution will be a local solution. Today's existing and potential available technology offers many alternatives for imaginative applications. Not all solutions will cost out the same, and economics must play an important role in system acceptability. But cost and objectives are relative and vary from locale to locale. What may be prohibitive for one area might provide the very remedy for another area.

In conclusion, I would like to commend the equipment manufacturers for the ingenuity they have displayed in developing new and improved products to serve this important field of activity. The Solid Wastes Act of 1965 has helped to generate the kind of constructive thinking that will, I am sure, lead to some significant breakthroughs in the development of new concepts, as well as, the application of technology used in other fields to the age-old problem of handling and disposing of solid wastes.

LAND RECLAMATION

Frank R. Bowerman *

THANK YOU, MR. CHAIRMAN. Ladies and gentlemen: I would like to direct my comments this morning toward the theme that has grasped me with increasing conviction during these past 20 years of fairly close familiarity with solid wastes problems. That theme is that solid wastes can be considered an asset, rather than a liability if we will only release our thinking from older stereotyped patterns. A profound change occurs in our consideration of solid wastes when we turn from an assessment of the problems attendant upon routine collection and disposal, and start thinking about the potential solutions that can be found in the imaginative and constructive use of solid wastes. Some of these potential solutions lie in sanitary landfilling. That is the focus of my discussion this morning. But that is not to say that we cannot find plus values for solid wastes in other areas of disposal: For example, the recovery of waste heat from incineration; the obtaining of useful humus for soil building through composting; and the salvage and recovery for further use of metals, glass, rags, and other discards from our affluent society. Note how different our approach becomes when we start to consider the possibilities that lie in such planning. I would very much hope that the theme of this conference becomes much more than a consideration of the problems and solutions for solid wastes management in the District of Columbia; rather, that the conference direct its attention toward the optimization of solid wastes management here and in the region surrounding the District, so that this area becomes the national showcase for solid wastes management and points the way for the rest of our nation. Is this an impossible dream? I don't think so. We dreamed a dream in Los Angeles County in 1949 and by 1956, some seven years later, we had converted that dream into a reality. You see, dreams only provide the challenge; it is hard work and perseverance that provide the reality. But dreams can become real, and I'd like to show you by way of some slides the simple but effective techniques that I helped develop in using sanitary landfilling for the construction of parks, golf courses, and botanic gardens in Southern California.

One of our prime criteria was that the sanitary landfills would be operated just as though they were a private business. Governmental agencies can do this if they set their minds to it. In our case, each of the sites became self-sufficient through the charging of prices for disposal. The hours were established just as with any business establishment. In the interest of the people around the various landfills we closed on Sundays, so that there would not be any activity on those weekend days when most refuse collection activities have ceased. The hours of opening were such as to protect the people during the evening and early morning hours against the noise that comes from a sanitary landfill. Each site has its own weigh-scale facilities, so that the charges are assessed directly on a tonnage basis. A distinction was made between "difficult-to-handle" materials, such as tree trunks, refrigerators and the like; the price for that is double the normal price. Currently in Los Angeles County the cost for refuse disposal is $1.25 per ton — that's the charge, not the cost; most of the large landfills in Los Angeles County are operating at costs of around 60 to 70 cents per ton, including overhead and all charges. So these are actually making money; government makes a profit. But the Sanitation Districts commit that profit back to a useful public purpose and the moneys which are surplus to the needs of the operation are being put into a reserve fund for buying more land as the existing landfills are used up. At the larger landfills there are two, and in one case at a very large landfill, three, weigh-scales, since if the customer is to be well served he must be provided with the means for prompt weighing. We cannot have costly collection vehicles and drivers standing in long lines of traffic waiting to be served.

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* Assistant to the Vice-President — Development, Aerojet–General Corporation. Mr. Bowerman's entire presentation was made while using slides for illustration.

The L. A County Sanitation Districts have specially designed transfer-trailer rigs for use at their transfer station. A diesel tractor pulls a semi-trailer which in turn pulls a full trailer. The two trailers are identical, the second one being converted from a semi- to full trailer by the use of a dolly. These units can carry up to 24 tons per trip, and the present state of economics in Los Angeles, and I would guess that it's not far different in the Washington area, is that by the use of this transfer equipment, remote landfill sites up to 50 miles distant from the transfer station, can be used economically as compared with costs for incineration. By that I mean a 50-mile trip out and a 50-mile trip back is about the breakpoint in Southern California for comparing the costs for transfer and landfill with the current costs for incineration. You see this extends the possibility for sanitary landfilling to a very large area.

The basic operation at Los Angeles County Sanitation Districts' Landfills calls for the dumping of the solid wastes at the base of the hill; the hill is created artificially at the commencement of the operation. By pushing the material upward, the bulldozer tracks grind, pulverize and compact the material much more effectively than if the material is placed on the top and the bulldozer simply runs over the larger, deeper mass. Good landfilling practice requires each day's operation to be sealed tightly with an earth cover of at least one-foot thickness. For areas that are to be left for a year or more between filling, two feet of earth cover are placed and for a final cover, where the operation is to be terminated with a golf course or a park or arboretum, three feet of earth are placed as final cover.

The piece of equipment that is standard on the Districts' sanitary landfills is the Caterpillar D-8 bulldozer or its equivalent. The operator is furnished an air-conditioned helmet. This has a small cooling and heating unit attached to a flexible piece of hose that leads into a helmet which serves as a safeguard as well as to prevent the breathing of dusty air. It has been a very important factor in the operation and has protected the men against a number of otherwise bad injuries.

At the larger sites, a number of bulldozers, which weigh about 25 tons apiece, are used, and the operators become very skilled in their performance. It is necessary to go through a training period to show the men how to operate the equipment in this type of environment. It is different than the normal type of earthmoving. Many different types of vehicles are serviced at sanitation district landfills. Los Angeles County sites may be a little more difficult to operate than most of the municipal operations because they are open to the general public. When Jane and John Doe come in with a trailer load of material, they may occupy the dumping space for quite a bit of time while they push the wastes off with a shovel; special provisions must be made at a public site, which is open to everyone, as compared to municipal sites where the truckloads arrive in 3- to 5-ton lots.

The Mission Canyon Landfill site is in one of the finest residential areas in that part of Los Angeles. Homes have been constructed on undisturbed land and the fill is being carried on in the immediately adjacent area. It is interesting that the landfill was in operation before any nearby homes came into existence. When this site was planned, ridges of land were deliberately left in the hands of the private subdividers, because they were far too expensive for the Districts' purposes and earth was not needed for cover. When these pieces of land were subdivided, the question arose as to whether they would be readily saleable. The answer is that the subdividers sold most of those parcels of land at prices upwards of $35,000 per lot, averaging about three lots per acre, and the homes that have been constructed on these lots are in the $75,000- to $125,000-class. These homes immediately overlook a sanitary landfill. It sounds incredible but homeowners are well aware material much more effectively than if the material is placed on the top and the bulldozer simply runs over the larger, deeper mass. Good landfilling practice requires each day's operation to be sealed tightly with an earth cover of at least one-foot thickness. For areas that are to be left for a year or more between filling, two feet of earth cover are placed and for a final cover, where the operation is to be terminated with a golf course or a park or arboretum, three feet of earth are placed as final cover.

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There are probably about 35 different cities using this sanitation district's sites at present. In order to make use of some canyon sites, access roads have to be built and they should be well maintained. Pipelines with high pressure water supply are essential for keeping down the dust and for fire protection. A basic earth mover is a twin-powered scraper — these are rubber-tired so that they can move rapidly and can carry a lot of dirt with just one driver. A water-wagon (6,000-gallon capacity) with a nozzle on the front and sprinklers on the front and rear is used for keeping down the dust, for fire prevention and for keeping papers from blowing around. It is very important that rainfall drainage be provided. Completed portions of the fill should have adequate surface drainage to keep the rainfall from percolating down through the rubbish and maintain it in a drier condition. One of the Sanitation Districts' finished landfills is now called the South Coast Botanic Garden. Before the commencement of the fill the bottom of the mined-out pit was actually 100 feet below street level. The plan called for the reestablishing of an original ridge line, and there is now a total of about 140 feet of fill. Homes were on one side of the street at the time that the landfill started; there were vociferous protests, but those same people are now very good friends of the Sanitation Districts and happy to have a botanic garden across the street instead of an old mined-out pit. One of the "bonuses" built at one of the more remote sites was an overnight camping facility along the side of the road. When you give people proof of a plus benefit, it rather sugarcoats the entire proposal. In this case there was an approximate 10-acre roadside rest camp provided to show the people in the area that the District had good intentions and that the ultimate use of the landfill would be for park purposes. People don't want to wait until the landfilling is all done before they get some use of the property. Many people don't trust government anyhow, thus it's just as well that you show them right at the beginning that you're honest! At another site two "little league" ball diamonds have been constructed on a landfill in the center of a large canyon; only a portion of the canyon had been filled at the time and the ballparks were built in order to get that area under use without waiting for the entire canyon to be filled, since the complete filling of that very large canyon was estimated to take another fifteen years. When the fill is completed the ball diamonds will have been covered up and no longer useable, but two 18-hole golf courses will be provided on the final surface. Since the city of Glendale owned the canyon site, the Districts worked out an arrangement whereby they leased the property at a 25 cents-per-ton charge. During the life of the operation of the sanitary landfill at this site, the City of Glendale will net 3.75 million dollars from their part of the charges for disposal. The city has been willing to commit, in writing, those funds to the construction of the future regional park to be built at the location.

As part of the public relations efforts, the Districts conducted Rotary and Kiwanis Club luncheons, right on the surface of the fill with the operation being conducted in the background. The men enjoyed it and were completely convinced that the operation was innocuous. These men went back into their community and convinced other people that the operation was just as had been promised.

On one of the hills in Los Angeles County a landslide occurred and three homes were destroyed. The lots on which those homes rested slid down into the bottom of the small canyon. The people further up the canyon were worried that the same thing would happen to their homes. As a result, the City staff and District engineers obtained from these people free access rights to their backyards for sanitary fill purposes.

By landfilling the canyon, the people obtained security against further landslides, as well as usable backyards. The only thing that the property owners contributed other than the use of their property was that they each chipped in about $100 per lot to buy the drainage pipe that was installed for draining rainwater through the canyon. It's an area with a good many horse lovers, and so a good number of the backyards were converted into corrals. There are many many instances where such things can be done, and once you have done one or two, then the invitations start rolling in asking you to assist in other such operations. It's a good partnership between government and citizens.

In order to make sure that the landfills did not contaminate the ground water, the State Water Quality Control Board in cooperation with a local sanitary engineering firm conducted a study on gases and percolating effluents. A full-scale test was made using various materials to "seal off" simulated disposal sites. In going from laboratory to full scale, a pit was dug in the ground, lined with burlap and then lined with polyvinyl chloride plastic sheets. Gas probes were placed down through the polyvinyl into the outer area; also gas probes were placed inside so that a check could be made on the difference in the concentrations of gas. The pit was then filled with refuse in a normal compaction procedure; that test was a failure. When we dug down to find out why the gas concentration was as high outside as inside, we found that one thing that had been overlooked was that as the material settled, it stretched the polyvinyl, scratching the sidewalls and perforating the plastic. So, back to the drawing boards and the next attempt produced much better results with an asphaltic material. I confidently predict that with more development we will come up with ways and means of making sanitary landfills secure in almost any type of a ground water environment.

In conclusion, may I respectfully suggest that the technologies that are available today are ever so much better than in 1949 when we set out to develop a countywide program in Los Angeles County. Then we had to cut and fit as we went along; today, a wealth of know-how exists, ready and waiting to be applied. Can we not dream another dream? Is it possible that from the fires and ashes of Kenilworth will rise, like the phoenix bird, a system for solid wastes management that will be the pride and not the disgrace of our beautiful capital city?

REFUSE REDUCTION PROCESSES

Elmer R. Kaiser *

THE SOLID WASTES of our society comprise two basic types, which can be distinguished at the outset. The first, which we call *refuse* is the household, trade, and industrial waste which contains organic combustible matter and usually a lesser but important fraction of noncombustibles, such as glass, ceramics, metals and mineral matter (ash). This paper relates to the reduction in volume and weight of such material. A second . . . important type that will be excluded from discussion, but which is nevertheless an associated municipal problem, we call *rubble*, such as broken pavement, concrete, stone, bricks and excavation materials. Such material is sufficiently devoid of organic or putrescible matter as not to require processing beyond transportation and compaction at suitable sites. A third type, excluded for the present purpose, is the *metal scrap* that normally moves to scrap processors for recycling in the metal trades.

The refuse of a metropolitan area of the size and population of the District of Columbia is so voluminous that reduction in volume is basic to any practical method of disposal. Reduction in weight is secondary. Reduction in both volume and weight is ideal. This paper treats the subject without special reference to any specific urban area.

A community's refuse varies daily, weekly, and seasonally within important limits, and should be investigated for specific areas. However, much can be learned from a near-average mixture, as the principles of waste reduction apply broadly and can be adapted to given situations.

The composition of a municipal refuse, which represents average conditions, at least for an East Coast area, is presented in Table I. The data were obtained by hand sorting of 4 lots of 1,500 to 2,000 lb each, taken at different times of the year from an incinerator plant bunker. They have been found to compare closely with data from other U.S. sources.

The daily solid wastes collected from residences, parks, trade and industrial establishments may be considered to weigh 150 lb per cubic yard (5.5 lb per cu ft) in receptacles or piles, prior to loading into vehicles. This is a good base point to begin a discussion of reduction processes, because it is from this point on that the refuse leaves the public or customers to be served.

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TABLE I

EXAMPLE REFUSE COMPOSITION IN WEIGHT PERCENT

Cardboard	7
Newspaper	14
Miscellaneous paper	25
Plastic film	2
Leather, molded plastics, rubber	2
Garbage	12
Grass and dirt	10
Textiles	3
Wood	7
Glass, ceramics, stones	10
Metallics	8
Total	100

Assuming 4.5 lb waste per capita day, a generally accepted figure, the volume at the source of such waste from a community of one million persons is 30,000 cubic yd per day.

Compaction-type vehicles will temporarily reduce the volume depending on the pressures produced, because the air voids in the refuse charged to the vehicles are about 95 percent of the space occupied. Compaction in the vehicles is ordinarily not over a factor of 2 or 3 because of the forces required. The vehicles then deliver the refuse to reduction sites or plants, where partial restoration to the initial volume results from unloading.

REDUCTION PROCESSES

Refuse reduction is practiced by several processes: (1) Open burning at dump sites; (2) Burning in conical metal chambers; (3) Landfilling, sanitary or otherwise; (4) Composting, with sale of compost; (5) Incineration without heat recovery; (6) Incineration with heat recovery.

On a pilot scale, at least one municipal plant in Demark is pyrolyzing the refuse by destructive distillation to reduce it and to produce useful products.

To the extent that salvaging of solids is practiced in conjunction with each of these processes, or the conversion of the solid residue of burning to useful products, the reduction of refuse is enhanced. In each case, solid matter is left for disposal by burial.

Open Burning at Dump Sites

The reduction of refuse volume and weight by open burning is practiced today where public and private funds have not been provided for more acceptable methods. The objections are numerous. The practice results in serious air pollution from smoke, fly ash, noxious gases and vapors, and odors.[1] The combustion of organics in the residue is not complete, leaving putrescible matter for decay, as food for vermin, rodents and birds. The fires are influenced by wind and rain; they smoulder for long periods, if not continually, depending on how well they are managed and on restrictions as to the type of material burned.

Because of the lack of complete burnout of the solids, incomplete decrepitation of glass bottles, little or no melting of aluminum articles, etc. the resulting residue would probably be 35 percent of the weight of the example refuse. The reduction in volume is hence not so complete as might otherwise be possible.

Variations of open burning are in use, such as in dish-shaped excavations, and even in refractory-lined pits, the latter with a system of overfire air nozzles. Modern air pollution criteria cannot be met by such methods as fundamental laws of combustion, heat transfer, and fluid mechanics are violated.

Open burning of refuse has been outlawed by six states and should be replaced by sanitary procedures.

Burning in Conical Metal Chambers

A number of conical metal burners have been installed in the United States to burn sawmill wastes, industrial and municpal rubbish. These burners are low in first cost and are an improvement over open burning because they confine the burning zone and prevent paper from blowing around the site.[2]

A high excess of air is introduced into the chambers to prevent temperatures that would be destructive to the metal shell and liner, and to the screen at the top where the combustion gases are emitted to the atmosphere. Forced air is supplied under the burning pile in the chamber, when the units are so equipped.

Because of the limited temperatures, and the direct path of the gases and entrained particles to the outside, the result is more smoke and fly ash than can be tolerated in populated areas. The reduction in refuse weight and volume can be greater than by open burning, depending on the care exercised in managing the fire. However, where the noncombustibles are allowed to accumulate and choke the porosity of the burning pile, and where quenching with water is used to expedite removal of the residue, some combustibles will be present.

Recently, one or more conical burners have been equipped with gas washers to trap fly ash from the gases. This is a step in the right direction, the evaluation of which will be of interest.

Sanitary Landfilling

The deposition of refuse in or on an engineered site, followed by compaction with tractors, and later by soil cover, results in a density of 750 to 900 lb per cubic yard. The densities vary, as would be expected, with the amount of bulky refuse with a high void content. Assuming 900 lb per cubic yard, the daily refuse from one million inhabitants would occupy a volume of 5,000 cubic yards or 3.1 acre feet. The refuse volume in landfill is thus one-sixth of the volume it had when it left the generating source, while the weight remains essentially the same. The total for the year would be a volume of 1,130 acre-feet or a 45-acre plot filled 25 feet deep.

Of course, it is possible to build a hill with sides sloped to 20 to 25 degrees, as is being done near Frankfurt, Germany, with trees planted on the slopes, and with a restaurant and viewing area at the top. The 15-year accumulation of refuse from one million inhabitants would build such a hill in the shape of a 150-foot truncated cone, with top 404 feet in diameter and base of 1,130 feet in diameter. Cover material would be extra, but would probably be excavated at the site. This example is offered to illustrate the magnitude of waste accumulation, and not as a proved solution to the problem.

Composting

The degradation of the organic fraction of municipal refuse by bacterial action may be classed as a reduction process. The weight loss of organic solids is about 40 percent through its partial conversion to carbon dioxide and water vapor, which diffuse harmlessly into the atmosphere.[3-4]

Wood, rubber, plastics, oily rags, metals, glass, stones, and minerals are not altered and are removed, more or less, from the material to be composed or from the final product.

The process depends for economics upon a market for the compost as a soil conditioner or humus. Composted refuse is not fertilizer because of its low nitrogen content, but it is useful in farming and horticulture. The experience to date here and abroad is that the market will accept limited tonnages, but not nearly as much as can be produced from the refuse of a large metropolitan area.

As a reduction process, composting is in a special category. Magnetic devices, picking belts and products sieves remove noncompostable reject materials which are disposable in landfill sites. Depending on the process, more or less of the sand, ash, glass and plastics appear in the final product in shredded or ground material. The volume occupied by the uncomposted residue depends on the weight, degree of shredding, and compaction. The volume will be at least as much as from a good refuse combustion process, both considered on the same basis of no salvage.

Incineration

Incineration is a refuse reduction process, the objective of which is to convert refuse moisture and organics to normal components of the atmosphere by enclosed and controlled combustion. The primary products are chimney gases consisting of carbon dioxide (CO_2), water vapor (H_2O), and nitrogen (N), and a solid residue of glass, ceramics, metals and mineral ash. Excess air supplied for complete combustion, consisting of nitrogen, oxygen and water vapor, passes through the incinerator and exits with the gaseous products of combustion. The carbon dioxide and water vapor from the combustion of the cellulose and other organic matter thus return to the ecological cycle from which they came.

It should be remembered that plants are the source of wood, paper, food, textiles and organic matter, and that plants require atmospheric carbon dioxide and rain water for growth. Whether by combustion or natural decay, essentially the same amount of CO_2 and H_2O are recycled to nature.

The chemical and thermal processes by which reduction is achieved through combustion is readily explained by a few simple tabulations. The refuse composition of Table I becomes the refuse analysis of Table II below:

TABLE II

TYPICAL REFUSE ANALYSIS

	Weight, percent	Lb per ton of refuse
Moisture	28.0	560
Carbon	25.0	500
Hydrogen	3.3	66
Oxygen	21.1	422
Nitrogen	0.5	10
Sulfur	0.1	2
Glass, ceramics, etc.	9.3	186
Metals	7.2	144
Ash, other inerts	5.5	110
	100.0	2,000

The calorific valve (HHV): 4500 British thermal units (BTU) per pound.

In a well designed and operated U.S. incinerator, the refuse is burned on moving grates in refractory-lined furnaces with ample air supplies both through and over the burning bed of refuse. Furnace temperatures are controlled in the 1,400 to 1,800 F range, with temperatures in the bed of up to 2,500 F.

The ingredients that join in the combustion process include refuse, stoichiometric air, 200 percent excess air, and air moisture, in the amounts shown in Table III. Part of the excess air enters the system after the primary combustion chamber.

TABLE III

INPUT FOR COMBUSTION AT 200 PERCENT EXCESS AIR

	Lb per ton refuse
Refuse, mixed	2,000
Dry air	18,930
Air moisture	250
Total lb	21,180

The refuse moisture is evaporated during the initial stage, after which ignition proceeds through the charge. Combustion and distillation occur in the burning layer, with over 96 percent completion of combustion in the gas space above and beyond. Even the metals present are partly oxidized, with corresponding gain in weight.[5] The resulting products, including primary products, air contaminants and unburned carbon, are listed in Table IV below:

TABLE IV

PRODUCTS OF INCINERATION

Stack Gases	Lb/ton	Volume, cf	Dry vol, %
Carbon dioxide	1,738	14,856	6.05
Sulfur dioxide	1	6	(22 ppm)
Carbon monoxide	10	135	0.06
Oxygen	2,980	35,209	14.32
Nitrogen oxides	3	23	(93 ppm)
Nitrogen	14,557	195,690	79.57
Total dry gas	19,289	245,919	100.00
Water vapor	1,400	29,424	
Total	20,689	275,343	
Solids, dry basis			
Grate residue	471		
Collected fly ash	17		
Emitted fly ash	3		
Grand total, lb per ton of refuse	21,180		

Hence, the 2,000 lb of refuse is reduced to 488 lb, of which 21 lb or 4.3 percent is carbonaceous char and other combustibles. Putrescible matter should be under one percent of the residue.

Volume Reduction by Incineration

The ton of refuse had a volume of 13.3 cubic yard (150 lb/cubic yd) at the generating source. As the result of compaction in the collection trucks, and later when loaded into the 25- to 30-foot deep bunkers of the municipal incinerator, the refuse volume decreased to 5.7 cubic yards (350 lb/cu yd). The loose incinerator residue of 488 lb (dry basis) leaving the furnaces occupies about 1.0 cubic yard, of which 75 percent is the volume of the tin cans, wire and metallic items. The residue is saturated with water from quenching, which merely adds weight but not volume.

When the residue is deposited in landfill, compacted by tractor in the usual manner and left for a year, the tin cans disintegrate to rust. The final bulk density is 2,700 lb per cubic yard of dry matter.[6] Allowing for the gain in weight of the metal converted to oxide, the residue from the original ton of refuse occupies 523/2,700 = 0.194 cubic yard. The material contains voids because of the granular nature of glass shards, fused clinker, loose ash with a minor amount of combustibles.

The volume reduction by incineration is indeed impressive. Starting with 2,000 lb of refuse, the comparable volumes are indicated below:

	As collected at source	Raw refuse landfilled	Incinerated and residue landfilled
Cu yd	13.3	2.22	0.194
Vol ratio	68.5	11.5	1.0

Where incineration leaves more unburned matter in the residue than the 4.3 percent allowed for in this example, the residue volume is greater and the volume ratios less favorable. The ratio is also influenced directly by the proportion of inerts in the refuse.

Metals salvaging from the incinerator residue is practiced at some incinerators, with shipments of the shredded tin cans to the copper industry. In France and Germany, the steel is baled and sold to the blast furnaces, where it is converted to molten pig iron. The residual tin content has discouraged the U.S. steel industry from purchasing such scrap.

The nonmetallic fraction of the residue can be sintered into concrete aggregate, as is done in Berlin-Ruhleben, but such material must ordinarily compete with stone and sand. A sized fraction of the residue grit would also be useful for sanding streets during icy weather.

Attention is called to the demonstrated possibility of oxidizing and melting the incinerator residue. The glass component is liquid at 1,800 F and most of the ash is molten at 2,350 F. The mutual solution of the oxide assists the melting process. The molten magma can be flowed into simple molds to harden into large pieces with a density of 2.40. When the slag stream is run into water, a coarse black glassy sand is produced, which would have use as a road or concrete aggregate. The bulk density of this glassy sand is 1.47 lb per cubic foot (2,500 lb per cu yd). The bulk density of a 50-50 weight mixture of larger and smaller aggregates is about 102 lb per cubic foot (2,760 lb per cu yd) uncompacted.

We thus have the technical possibilities for reducing to nil the volume of land required for incinerator residue. Economic factors will control the ultimate solution in any area.

Air Pollution Control of Large Incinerators

Incinerators of over one ton per hour input employ forced underfire air to develop economical rates of operation and effective operating temperatures. As the material burns the minerals are released as ash. Particles of dust and bits of paper are carried upward and out of the primary combustion chamber in amounts ranging from 10 to 40 lb per ton of refuse. About half of the weight of these entrained solids is carbon, which largely burns to carbon dioxide in secondary combustion zones and refractory-lined flues; the remainder stays in suspension or is trapped.

The "filtering" of the solid particles from the final combustion gases is usually preceded or accompanied by a gas cooling stage employing water sprays, the addition of air, or both. The gases may take an irregular path through sets of wetted baffles which trap dust. The gases may also be swirled intensively in cyclonic dust collectors which remove solids from the gases by centrifugal force. Gas scrubbing by intimate contact and turbulent mixing with water is another method for efficient dust removal. In the United States tests have been run in recent years with electrostatic precipitators and bag filters, both highly effective in industrial applications. Electrostatic precipitators of 98 to 99.5+ percent efficiency are used in many large new incinerators in Europe. In other words, the means are available for reducing incinerator dust emissions to meet the new dust-emission standards.

Referring again to our example refuse and incineration process, we indicated a dust emission of 3 pounds per ton of refuse. Such determinations are made by actually sampling the flue gas in a scientific manner, filtering the dust from the sampling stream, drying and weighing the dust, and comparing the dust weight with the weight or volume of gas flowing. Correction is made to a constant excess air content of the stack gases, so that the comparison with a standard or results from other plants would be on the same basis and thus meaningful. For this purpose the flue gas is analyzed for the volumetric proportions of the principal gases.

The example dust loading may be expressed in several equivalent ways:

Lb per ton of refuse charged	3.0 lb
Lb per 1,000 lb actual flue gas corrected to 50% excess air	0.270
Grains per cu ft of actual flue gas at 50% excess air, 68 F, 29.92 in. Hg	0.139
Milligrams per cubic meter at 0 deg C., 760 mm Hg and 7.0 percent CO_2	211

U.S. dust emissions standards range from 0.85 to 0.20 lb per 1,000 lb of flue gas at 50 percent excess air. The standard applicable throughout West Germany is 150 mg per standard cubic meter, which is equivalent to 0.192 lb per 1,000 lb of flue gas at 50 percent excess air, or 0.099 grains per cubic foot. To meet the West German standard, the example incinerator would have to have a dust emission of 2.13 lb per ton of refuse.

The more restrictive new U.S. and European standards can be met by the use of electrostatic precipitators, gas scrubbers, and bag filters of high efficiency. Such equipment has been in industrial use for years. Gas scrubbers have been applied to several large incinerators. It is expected that electrostatic precipitators will soon be installed on incinerators in this country.

European Incinerator Art

In Europe under conditions of high fuels costs, lower labor costs, and a high technological level of construction and plant operation, as well as the desire to conserve land area, the incinerator art has flourished since 1962. The objective of reducing refuse to minimum volume has been combined with the desires for heat economy and low air pollution. The combination is mutually assisting. As a member of the U.S. Study Team of June-July, 1967, led by Mr. Leo Weaver, Chief of the Solid Wastes Program, Public Health Service, it was my privilege to see several of these plants. Descriptions and technical information are also available in several excellent papers published by the American Society of Mechanical Engineers in the proceedings of the 1964 and 1966 National Incinerator Conferences.

These new-type refuse reduction plants consist of refuse receiving pits, cranes with grapples to elevate the refuse to hoppers, stoker-fired boilers, electrostatic precipitators to trap the flue dust, and chimneys 260 to 390 feet high.

Because of the water-tubed furnaces, the refuse can be burned with 1.6 times the stoichiometric air, instead of 3 times as in U.S. practice; the weight and volume of flue gas to be cleaned is reduced considerably. The cooling of the gases to 500 to 600 F in the boiler-superheater-economizer contracts the gas volume without the addition of spray water. The electrostatic precipitators, although large, are half the volume that would be required without the boiler.[8] The precipitators are guaranteed at 98 to 99 percent collection efficiency, with test results exceeding guarantees. Finally, the gases are dispersed from high chimneys.

The steam generated is used for the production of electric power and for district heating, in conjunction with the local electric utility. For district heating, high-pressure hot water can also be produced for circulation through mains. U.S. refuse is lower in moisture and ash, higher in calorific value, and hence capable of generating more steam per ton of refuse.

American Incinerator Art

The U.S. incinerator art is on the threshold of a rapid evolution to meet rising requirements for capacity to consume refuse, better plant appearance, low emission of odor and air pollutants, minimum putrescibles in the residue, and less effluent water. The possibilities for steam and power generation from refuse are being restudied. The disposal of incinerator residue, salvage of metals, and utilization of residue are also under investigation. The plants will be more highly engineered, and will require better control and operating personnel to match. Close engineering ties are maintained with European progress.

The burning of oversized burnable waste with or without prior shredding is being developed. Trees, furniture, pallets, mattresses, truck and auto tires, and demolition lumber reduce to even less final residue volume than does the equivalent weight of normal refuse.

A major stimulation is the Solid Wastes Program of the Public Health Service. Through research and demonstration grants, conferences, educational and field efforts, and allied activities, new advances and trained personnel are resulting.

As public officials and the general public become aware of the long-range implications and opportunities of waste management programs, larger capital investments will become available for incineration plants and allied facilities. The regional approach to waste disposal will lead to larger and better incinerators. Engineers look forward to the opportunity to design plants which are in the long-range interest of the public, rather than to satisfy minimum first cost. The total annual cost of refuse incineration will thereby not exceed about $6 per inhabitant served.

Destructive Distillation and Gasification of Refuse

Experimentation here and abroad indicates that the organic matter in municipal refuse can be converted to gaseous, liquid and solid products by heating to 1,300 to 1,500 F out of contact with air. After the distillation of the moisture, the organic matter is converted to roughly equal weight percentages of water vapor, gases, liquids and char.

In descending order of volumes, the fixed gases are mainly CO_2, CO, CH_4 plus higher hydrocarbons, hydrogen, and nitrogen. The liquids range from alcohols to tars. The char is primarily carbon and ash.[9]

Refuse can also be gasified in a deep bed gas producer supplied by air at less than half the stoichiometric combustion requirement.

Pilot-scale work is in progress to determine yields and costs. It is too early for predictions of the outcome. However, as a method of reducing waste, the residue would require the same landfill space as the residue from incineration.

ACKNOWLEDGMENT

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RECYCLING AND UTILIZATION

C. I. Harding *

MOST RECYCLING and utilization schemes involve some type of salvage and composting. A working definition of refuse composting is "the aerobic, thermophilic degradation of putrescible material in refuse by micro-organisms." There is no clear definition at this time of when a material becomes "compost" nor is there any general agreement upon the composition of the material which is referred to as compost. Operationally, the stabilized refuse or compost should not go anaerobic during storage either in bags or in bulk. With this crude criterion for what constitutes refuse compost we can examine the bases for the various composting systems available today.

Anaerobic decomposition of waste materials has been practiced to produce soil additives in Asia for centuries. Aerobic composting has been practiced in Europe since the 1920's and 1930's but the European practices are not directly applicable to refuse composting in the United States because of the difference of refuse composition in the two areas.[1] Studies by Wiley[2] and Schultze[3] showed that the majority of putrescible material in U.S. refuse can be stabilized in five to seven days with aerated bin processes. This work and subsequent commercial developments served as a basis for the selecting of five to six days as the average decomposition time for the ground refuse in U.S. mechanical composting processes. Windrow systems require a much longer composting period. From two weeks to three months are required for adequate stabilization of refuse in a windrow operation.

The temperature achieved during composting should exceed 140° F for a minimum of four days to insure adequate stabilization. The refuse should be ground to a particle size less than one inch, the moisture content of the ground refuse should be increased to about 55 percent (based on total weight) and the carbon-to-nitrogen ratio should be adjusted to approximately 40 for most rapid stabilization. Mixed refuse has a very high paper content. The carbon-to-nitrogen ratio of this material can be expected to exceed 70 most of the time. This requires the addition of either sewage solids or nitrogen solutions to adjust the carbon-to-nitrogen ratio prior to digestion.

Mixed refuse has a wide variation in chemical and physical composition. Data on composition are found in the book entitled *Municipal Refuse*

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Disposal prepared jointly at APWA and APHA.[4] Recently contracts have been let by the Public Health Service for development of current data on refuse composition and quantities. The composition data presented in Table I is of primary interest to designers and operators of compost plants.

TABLE I

COMPOSITION OF MIXED REFUSE RECEIVED AT TWO MECHANICAL COMPOSTING PLANTS

(TABLE ENTRIES ARE WEIGHT PERCENTAGE)

Component	Metrowaste plant[5] Houston, Texas	IDC plant[6] St. Petersburg, Florida
Newsprint	1.7	Not separated
Corrigated cardboard	0.5	Not separated
Ferrous metal, total		10
Ferrous metal, cans	7.1	—
Ferrous metal, tramp	1.8	—
Rags	0.2	Not separated
Noncompostable (tailings)	2.1	10
Compostable	86.6	80

U.S. COMPOSTING SYSTEMS

All composting operations can be broken into three basic steps: refuse preparation; stabilization; and product upgrading. The preparation includes receiving, sorting and salvaging operations, grinding, and the addition of moisture and nitrogen. Stability or aerobic digestion can be accomplished either in windrows in the open or in mechanical plants. Product upgrading consists of grinding, enrichment, granulation, shipment, and marketing. The details of refuse preparation, product upgrading and the composting systems available will be discussed separately.

Refuse Preparation

Some degree of hand and mechanical sorting of the incoming refuse is required in any of the composting operations in use in the United States. This sorting is required to remove noncompostable material, bulky items, and items which may have some salvage value. Most U.S. systems use hand picking from a slowly moving belt and magnetic separation of ferrous metals. Some systems include inertial separation in an attempt to further separate noncompostable items from the organic matter.

Grinding is required for efficient composting. This can be accomplished in either hammermills, chainmills, a rasp type grinder, or with wet pulping followed by screw-press dewatering. This latter method of grinding would be successful with only one of the four types of composting systems in use in the U.S. today. The power required to operate the grinders varies from

3 to about 30 hp. per ton per hour grinder capacity. In most plants now being constructed, grinders are sized large enough to permit all grinding to be accomplished on a one-shift operating basis. Thus the capacity of the plant could be tripled by simply adding additional digester capacity and operating the pre-and post-treatment units on a three-shift basis.

Figure 1 shows the inertial separation phase planned for the Gainesville Compost Plant. The primary grinder is a Centriblast unit which does impart a certain trajectory to the materials leaving the unit. A secondary, inertial separation is imparted by the jet slinger located on the Centriblast exit. The material leaving the Centriblast will then pass through magnetic separation.

Two stages of grinding are usually used. The first stage or coarse grinding reduces particle size to about 2 to 3 inches. The second stage grinding usually produces particle size of approximately 0.25 to 1 inch. After grinding, the material is moistened with either sewage sludge, water or dilute ammonium nitrate solution, then conveyed to the digestion phase.

Product Upgrading

The upgrading operations which follow digestion consist of some or all of the following: curing, grinding, screening, pelletizing or granulating, drying, magnetic separation, and bagging. Storage of refuse which has been stabilized to compost by high temperature for 5 to 7 days results in a slow curing or maturing process. This has the net result of producing a darker color material with a shorter fiber length, both changes make the material esthetically more desirable. Curing can be omitted in some plants providing the carbon-to-nitrogen ratio is adjusted to insure that a minimum of 1.5 to 2 percent nitrogen will be in the material when it is used for agricultural purposes. Most plants cure from 10 days to 2 months. When properly stabilized by high-temperature composting the material can be piled 15 to 20 feet high and left without turning for up to six months without going anaerobic. During this curing the temperature in the pile will remain near 140° F. The material removed from this type of pile will be very dark brown in color and should serve as an excellent soil conditioner or fertilizer filler.

Granulation can be accomplished by use of a short granulator followed by a dryer. The best example of an operating system of this type is found in the Altoona, Pennsylvania, plant where an attractive granular product is produced. The moisture content of the material as shipped in granular form averages about 10 percent versus the 40 to 50 percent moisture which is found in the run-of-the-plant compost produced in most other systems.

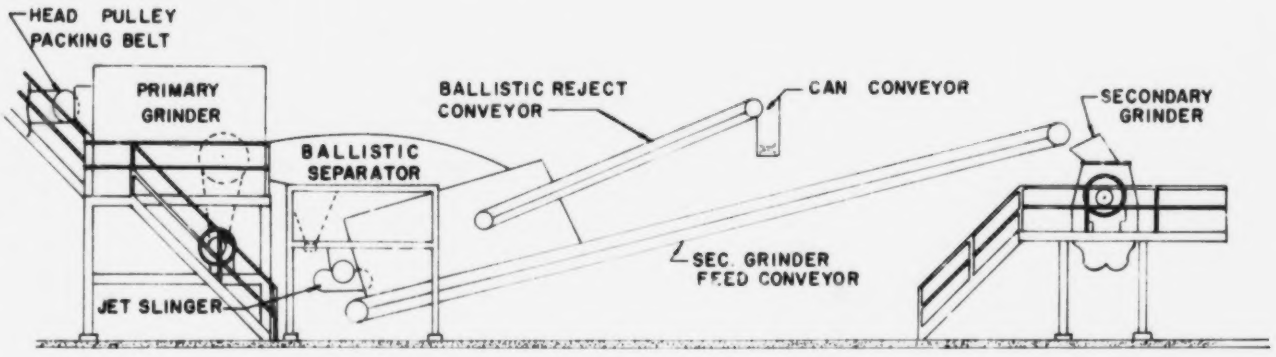
HEAD PULLEY
PACKING BELT
PRIMARY GRINDER
BALLISTIC SEPARATOR
JET SLINGER
BALLISTIC REJECT CONVEYOR
CAN CONVEYOR
SEC. GRINDER FEED CONVEYOR
SECONDARY GRINDER

FIGURE 1
Section through the grinders and ballistic separator at the Gainesville, Florida, Metrowaste plant.

Windrow Composting

The new TVA–PHS Demonstration Compost Plant at Johnson City, Tennessee, is of the windrow type. Refuse is brought into the plant, hand sorted, ground in either a Williams hammermill or a Dorr Oliver rasping machine, then is moistened and conveyed to the outdoor decomposition area where it is placed in windrows. The windrows are turned 5 to 10 times with a Cobey-Windrow turner during about 5 weeks of composting. After composting, the material is cured for 2 to 4 weeks. Windrow composting of this type has been practiced successfully in many locations. This process requires a moderately large area since the windrows are outside and the material is retained on-site in discrete windrows from one to two months. Calculations contained in Appendix A indicate that about 30 acres will be required for a windrow plant to serve a city of 100,000 population. This type of compost operation should be best suited for smaller cities with adequate land available and around which there exists a strong market for the compost produced.

Mechanical Composting Systems

Three mechanical systems have proved successful in composting U.S. refuse. They are: the Fairfield system; the Internationl Disposal Corporation (IDC) system (formerly known as the Naturizer system); and the Metrowaste system. The land required for these plants is much less than that required for windrow plants of comparable capacity. A 5-acre site should serve a city of 100,000 population.

The Fairfield System

A pilot plant which receives approximately 25 tons of segregated refuse from the city of Altoona, Pennsylvania, has been operating using this type of digestion equipment for several years. A schematic diagram of the process is shown in Figure 2. A Williams hammermill is used as a primary grinder with no prior hand sorting since trash and rubbish are supposedly collected separately. The secondary grinding is done in a wet pulper or hydro pulper. In this unit, sewage solids can be added as the moistening agent and the filtrate from the screw press which follows the hydro pulper can be returned to the sewage plant. A bar screen is located between the hydro pulper and the screw press to remove film plastics, tin cans, and other noncompostable items. The wet pulp at 55 percent moisture is fed into a circular digester. This digester is the only one of the three mechanical digesters mentioned in this paper which is a continuous process unit. Air is blown through the perforated bottom to keep the mixture aerobic. Differing amounts of air are fed to various sections of the digester to provide any

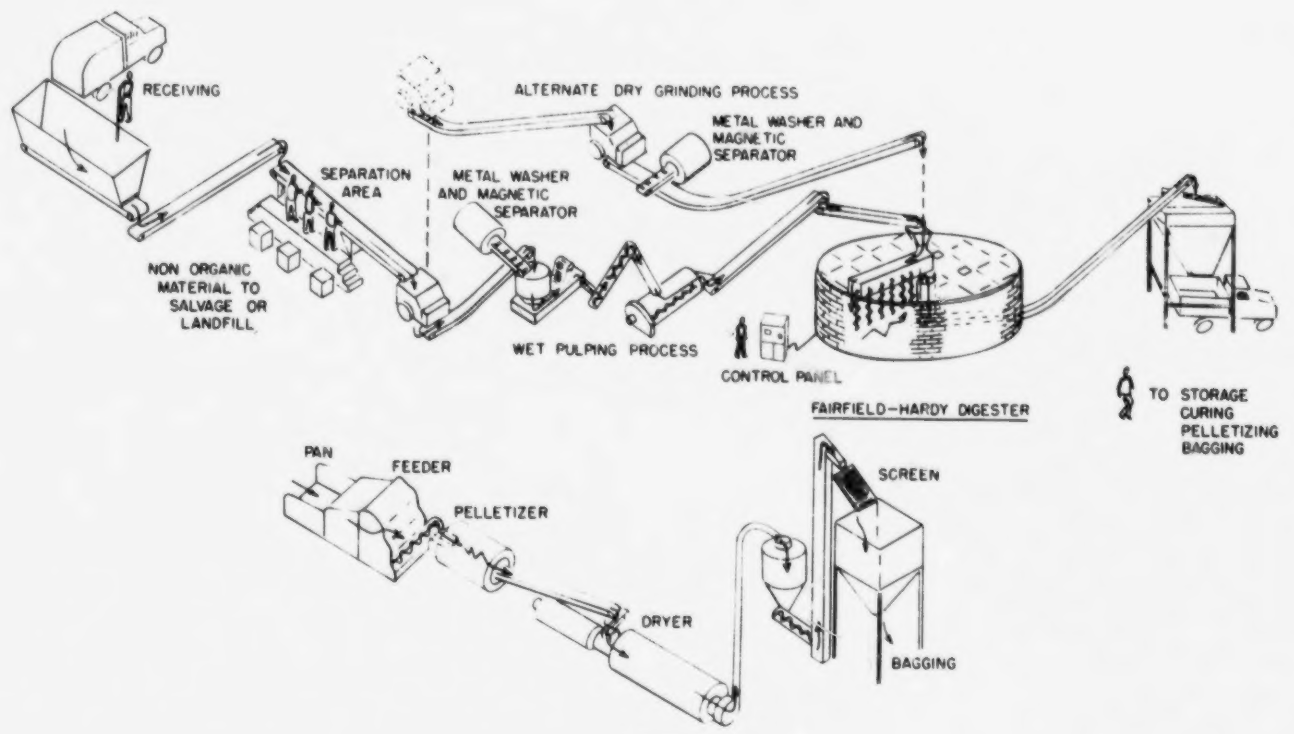
RECEIVING
SEPARATION AREA
NON ORGANIC MATERIAL TO SALVAGE OR LANDFILL
ALTERNATE DRY GRINDING PROCESS
METAL WASHER AND MAGNETIC SEPARATOR
METAL WASHER AND MAGNETIC SEPARATOR
WET PULPING PROCESS
CONTROL PANEL
FAIRFIELD-HARDY DIGESTER
TO STORAGE CURING PELLETIZING BAGGING
PAN
FEEDER
PELLETIZER
DRYER
SCREEN
BAGGING

FIGURE 2
Typical design for Fairfield Hardy Digester installation and related equipment.

desired temperature profile. The augers which operate on a revolving arm, continuously mix the material and immediately integrate the wet pulp into the composting mixture. Only this digester arrangement is suited for the acceptance of ground refuse from the hydro pulper. After a nominal 5-day detention time in the digester the material is removed and cured in windrows for about three weeks. The cured material is moistened with a starch suspension, granulated, and dried to provide an excellent quality granular product. For much larger installations it is anticipated that a picking belt will be installed as an integral part of the pre-treatment operations. The horsepower requirements for this type of digester are relatively high as are the operating costs since the agitation operates continuously. Expansion of capacity would require the construction of a complete new digester since the through-put of a digester is limited.

The International Disposal Corporation System

A 105-ton-per-day IDC plant has been in operation for approximately one year in St. Petersburg, Florida. Incoming refuse is sorted to remove large noncompostable items, then is run through a magnetic separator to remove ferrous metals and cans. The next unit, as shown in Figure 3, is a rotary mixer called a pulveriator into which is fed the refuse and a moistening agent, ammonium nitrate solution. The refuse leaving the pulveriator enters a patented flail mill grinder which shreds the refuse effectively but does not remove or shred rags and plastic items which enter the composting process almost intact. The plug flow digester is housed in a vertical building with horizontal, moving belts on which the ground refuse composts. Air is blown into the pile just above the belt to provide adequate aeration. Temperatures are in the thermophilic range. The material is reground after 2 day of the process. Then, at the end of 5 days detention time the material is removed, passed through a pentagonal trommel screen with 0.75-inch openings. This screen provides an excellent separation of noncompostable materials such as rags and plastics from the compost which is then ground and conveyed to outdoor curing piles. The material is cured for approximately ten days. It is then sold in bulk or enriched for bag sale. Expansion of digester capacity will require construction of a complete new digestion unit or the reduction of detention time in the digestion units which may result in improperly stabilized refuse if the time is cut too short.

The Metrowaste System

A 350-ton-per-day plant of this design has been in operation for approximately seven months at Houston, Texas. A 150-ton-per-day Metrowaste plant is under construction in Gainesville, Florida, scheduled to begin

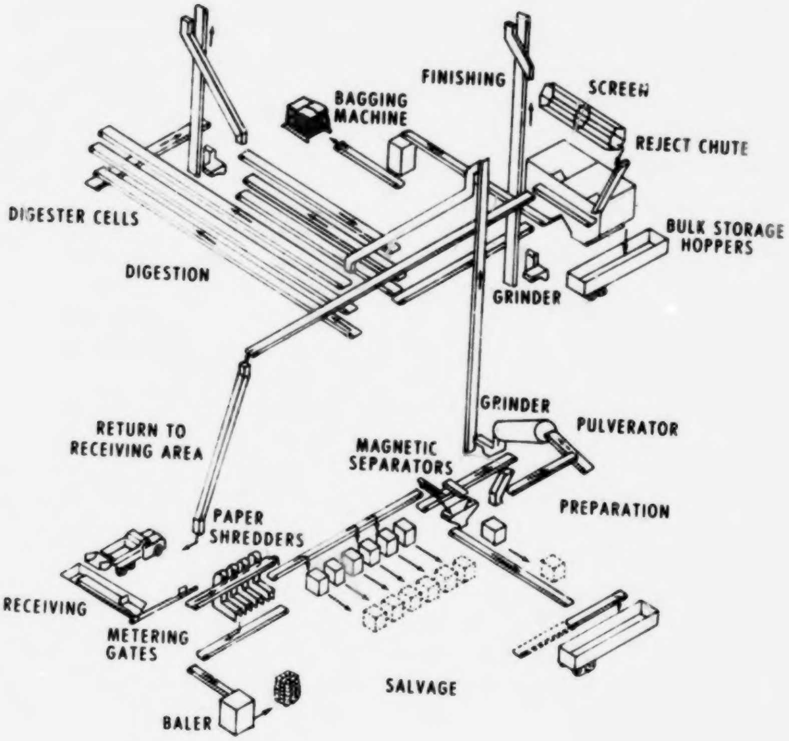
FINISHING
SCREEN
BAGGING MACHINE
REJECT CHUTE
DIGESTER CELLS
BULK STORAGE HOPPERS
DIGESTION
GRINDER
GRINDER
PULVERATOR
RETURN TO RECEIVING AREA
MAGNETIC SEPARATORS
PREPARATION
PAPER SHREDDERS
RECEIVING
METERING GATES
SALVAGE
BALER

FIGURE 3
Schematic diagram of the Naturizer System.

operation October 1967. In this process, shown schematically in Figure 4, the incoming refuse is hand sorted, ground in either a hammermill or a Joy Centriblast unit which provides inertial separation, passed through a magnetic separator, a secondary grinder, and is moistened with sewage solids or nitrogen solution prior to composting. The batch digesters used in this process are horizontal tanks with perforated bottoms. The ground refuse is kept in the tanks for 4 to 6 days depending on plant operating conditions. Air can be blown through the bottom either on a periodic cycle or continuously. A special agitator-unloader is used to mix the material or to unload it at the completion of the composting period. These tanks are usually built in pairs with a center belt serving for both feed and take off from each pair. One agitator can be used for the two tanks with a transfer table to shift from one tank to the other.

Experiments conducted with the use of oxygen enrichment during the first 12 to 24 hours of composting with this system have shown that enrichment materially reduces the time required to reach thermophilic temperature ranges. The oxygen content of the inlet air is increased to about 30 volume percent. This reduces the necessary detention time in the digester by one to two days.

Expansion of digestion capacity can be accomplished by adding additional digester length and still using the same agitator for the tank. This provides the cheapest additional capacity of any of the three mechanical systems. Upon completion of composting in the Metrowaste system the material is passed through secondary grinders, screened and either cured or granulated for sale.

A process utilized in the Metrowaste system which is not being utilized currently by other compost operators, is the use of air suction on the discharge side of the primary grinders to remove film plastics. Some quantities of the dryer paper and many glass fragments are removed also by this suction. These materials are burned in a suspension dryer to provide heat for burning out cans and drying of the material after curing and/or granulating.

The manpower required for operation of compost plants can vary between 1 man per each 6 tons of refuse processed per day to 1 man for each 15 tons of refuse processed per day. Capital costs, energy and labor requirements for the three mechanical systems are compared in Table II. A major operating cost which is not well documented at this time is the cost of hammerwear for grinding operations. This is reported to vary from 65 cents to $1.25 per ton of refuse processed.[6, 7] All three of the mechanical systems use forced aeration. The aeration requirements vary between 0.2 and 2 cfm per cubic foot of digester capacity.

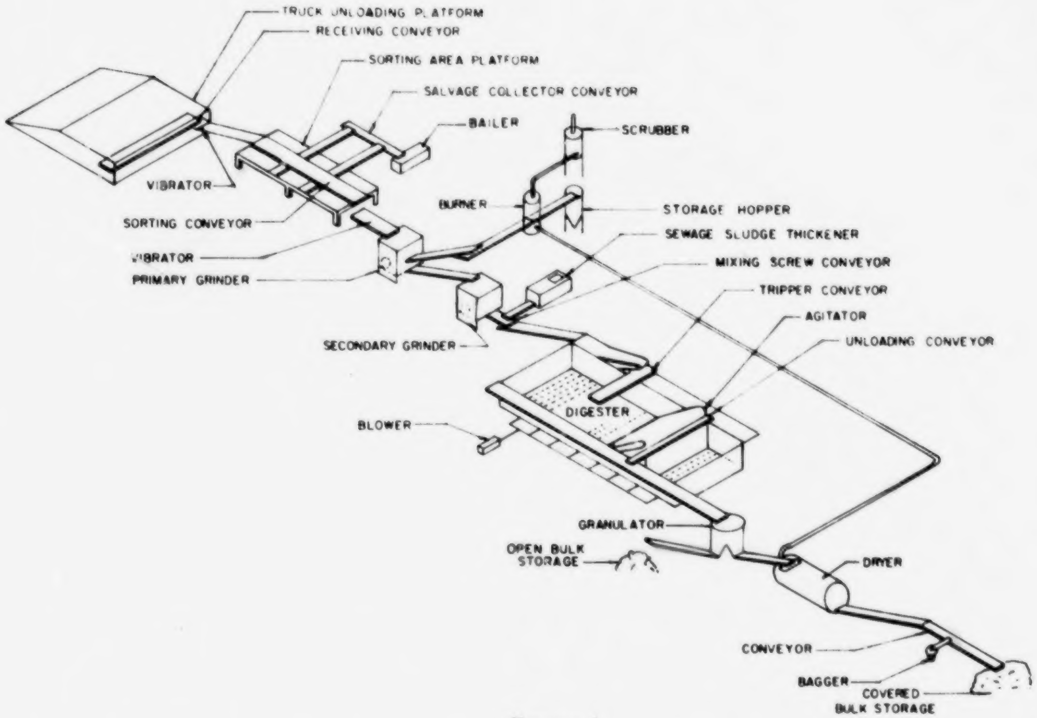
TRUCK UNLOADING PLATFORM
RECEIVING CONVEYOR
SORTING AREA PLATFORM
SALVAGE COLLECTOR CONVEYOR
BAILER
SCRUBBER
VIBRATOR
BURNER
STORAGE HOPPER
SORTING CONVEYOR
SEWAGE SLUDGE THICKENER
VIBRATOR
MIXING SCREW CONVEYOR
PRIMARY GRINDER
TRIPPER CONVEYOR
AGITATOR
SECONDARY GRINDER
UNLOADING CONVEYOR
DIGESTER
BLOWER
GRANULATOR
OPEN BULK STORAGE
DRYER
CONVEYOR
BAGGER
COVERED BULK STORAGE

FIGURE 4
Compost plant schematic flow diagram, Gainesville Municipal Waste Conversion Authority Incorporated.

TABLE II

COMPARISON OF ESTIMATED CAPITAL COSTS[a]
ENERGY AND MANPOWER REQUIREMENTS FOR MECHANICAL COMPOST PLANTS

Capacity (t/d)	Fairfield			Metrowaste			IDC		
	$\$ \times 10^6$	HP	Labor	$\$ \times 10^6$	HP	Labor	$\$ \times 10^6$	HP	Labor
100	1.4[b]	900[b]	8[b]	0.9	1,250	12	1.4	600	20
200	2.1[b]	1,400[b]	11[b]	1.2	1,700	17	2.1[b]	800[b]	28[b]
300	2.5	1,700	14	1.5	1,900	25	2.7[b]	950[b]	36[b]
400	3.2	2,500	20	1.6	2,000	30	3.2[b]	1,100[b]	45[b]

[a] Exclusive of cost or land and special foundation problems (fill and/or piling).
[b] Author's estimate based on chemical engineering estimating procedures.

SALVAGE RECOVERY AND MARKETING

Most salvage is accomplished by hand sortings and magnetic separation. The items which have salvage value are newsprint, corrugated cardboard, certain classes of rags, ferrous metal, cans, nonferrous metal (when separated) and glass. The market for any and all of these items is subject to wide variation from time to time and from location to location. Whenever salvage is being considered, it is best to contact the Executive Director of the National Association of Secondary Material Industries, Inc., whose address is 330 Madison Avenue, New York, N.Y. 10017, and request the name of salvage dealers in the vicinity under consideration. The salvage market is old and reasonably well established so nearly all salvaged material is sold through salvage brokers.

At this time the sale of paper salvaged from compost plants is meeting resistance because of "psychological warfare" being waged by long-time suppliers of salvaged paper through implication that the paper is somehow unsatisfactory." Only dry, clean paper should be sorted and recovered for salvage purposes. It has been successfully used in food containers and other applications. The instability of the paper market and the psychological factor are the only drawbacks on the salvage of paper goods. The paper market is depressed at this time so the prices quoted are nominal only. Baled newsprint may sell for $12 to $15 per ton and baled corrugated boxes from $7 to $12 per ton.[10]

Mixed rags are now at their lowest value in years.[11] Prices vary from $2 to $30 per ton.[11-12] Wiping rags, which in general are large garments of absorbant characteristics such as cotton, have a much higher value which can vary between $40 to $200 per ton. Assistance of a local textile salvage dealer should be sought in training personnel to pick only the proper types of rags for wiping purposes.

Glass or cullet can be sold in special circumstanctes to glass plants. Since glass is a supercooled liquid rather than a crystalline material, it melts at a much lower temperature than does silica (sand); hence some glass is recycled in glass manufacture to reduce the heat necessary to melt the sand. Again specific details should be worked out with a purchaser of the glass concerning the color and characteristics desired prior to attempting any salvage of glass at a compost plant. Usually glass is left in the compost and is abraided sufficiently during the process to be reasonably safe in the final product.

The only domestic market for tin cans is in the copper smelting industry located in the Western States. Unless there are special circumstances or special needs close by, it is impractical to consider salvaging of cans anywhere east of a north-south line passing through Chicago.[12] The closer the cans are to the mines in Arizona and New Mexico, the higher the price they will bring. Cans must be burned out and shredded prior to use in copper smelting. Much of this work is usually done by a salvage broker. Shredded, burned and baled cans may be suitable for export buyers at East Coast ports. This requires the seller to seek out possible markets. Routine scrap ferrous metals, known as tramp metal, can be sold in bales through normal scrap dealers located all over the country. Prices for properly baled material can reach $25 per ton.[10] Periodic prices can be found for all salvage material in the journal published by the National Association of Secondary Material Industries, Inc., published by Market News Publishing Corp., 156 Fifth Avenue, New York, N.Y. 10010.

Some hand sorting to remove noncompostable items is mandatory in most composting plants. The use of extended hand sorting should be weighed against the probable market for the materials separated by this process. Decisions to enter extensive sorting should be made only on the basis of firm contractual commitments for purchase of the products produced.

Compost Production and Marketing

From one-third to one-half of the materials entering a compost plant will become compost. Over three-fourths of the material entering the plant will enter the digester and a certain portion of this will be lost through biological activity. The length of curing, the type of upgrading operations, and the moisture content of the material as shipped determine what the ratio of final product to incoming refuse might be. At the present time, undried compost is being sold by Metrowaste and by International Disposal Corp. for approximately $16 per ton F.O.B. plant site.[6,7] The Altoona-FAM Co.

markets their granular compost at 10 percent moisture for approximately $16 per ton F.O.B. the plant.[8] Bag sales have not proved successful at the three plants now successfully composting municipal refuse in the U.S. The best potential bulk market for compost is as a building material in the fertilizer industry. The increasing popularity of organic fillers in fertilizers should provide an ample developmental market for compost. Some manufacturers of compost consider enrichment as the most desirable method to follow. The enriched compost can then compete directly with the fertilizer compound. Once enrichment is undertaken and a labeled material is being produced, fertilizer laws must be followed in the production of the material. The marketing work necessary for a large plant to move compost successfully is extensive. This is beyond the scope of most municipalities. A large private company would appear to have a potential advantage to providing adequate marketing services to move the final product.

Recently some rail carriers have established a new classification for compost materials.[7] The classification, "waste products," carries a 30 percent lower freight rate than fertilizer products. There still remains room for improvement since earth or stone can be moved by rail 60 percent cheaper than fertilizer products. If lower rates could be provided by rail carriers to compost producers this would make possible distribution of compost to a much larger area. At the fertilizer shipping rates the compost must be distributed within 50 to 100 miles of its point of production. With the reduced freight rates the radius of distribution can be extended considerably and still the product can be marketed profitably.

Financing Composting Plants

Financial personnel and engineers have worked together to develop a concept on which most of the current compost plant financing is based.[18] Since composting is a municipal refuse disposal function it should be underwritten by adequate dumping fees. These fees should cover the disposal phase of the operation which includes amortization of all capital outlays, a sinking or equipment replacement fund, all operating costs including the cost of transporting the compost to an ultimate disposal site for at least two years while market development is progressing, and a safety factor to provide for adequate charges for an alternate method of disposal during compost plant downtime. The alternate method may be landfill or incineration and would have to be conducted by contract or at standby facilities. All of these items should be covered by a guaranteed minimum dumping fee for the contract's period. A realistic escalation clause should be included in the contract to cover increase in labor and operating costs. The materials and the plant can be amortized over as much as a 30-year period if engineering data can substantiate the successful operation of the equipment for that length of time. In financing the plants no credit is given for sale of salvage material and an incineration cost should be included in the disposal phase to handle the disposal of plastics and other noncompostable but combustible items which are undesirable in the final product.

The second phase of the financing operation is the by-product phase. This includes final grinding, upgrading, marketing, granulating, etc., and should be financed by revenue received from the sale of the compost. Should this venture be undertaken by a private concern, the sale of the product would also serve to provide the profit for the operation. By separating the financing of composting into two phases — disposal phase underwritten by dumping fees and by-product phase paid for by compost sales, a realistic approach to financing composting plants can be taken.

For moderate-to-large size communities where space is a problem and pollution is a problem, composting can compete effectively with incineration particularly if the operators of the compost system have initiative and ingenuity in developing markets for the compost and salvageable items. The most advantageous situation for refuse composting is when it can be combined with sewage treatment. A city can save about 30 percent of the cost of sewage treatment by pumping raw sludge to a compost plant for use as a moistening agent and a source of nitrogen in the compost. When the savings in sewage treatment cost are taken as a credit against the cost of refuse composting, the economics of composting become attractive. This is particularly true when the process also eliminates a potential air pollution problem.

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APPENDIX

Calculation of Area Required for a Windrow Composting Plant To Serve a Population of 100,000

$$\text{Quantity of refuse} = \frac{(4\ \text{lb/c/d})\ (100{,}000)}{(2{,}000\ \text{lb/ton})} = 200\ \text{t/d}$$

Compostable quantity (80% from Table I) = (200 t/d) (0.8) = 160 t/d if density = 400 lb/yd^3

$$\text{Volume} = \frac{(160\ \text{t/d})\ (2{,}000\ \text{lb/ton})}{(400\ \text{lb/yd}^3)} = 800\ \text{yd}^3\text{/d}$$

With a windrow 5.5′ high, 10′ wide at the base and 6′ wide at the top, the cross-sectional area = 5 yd^2

$$\text{Daily length of windrow} = \frac{800\ \text{yd}^3\text{/d}}{5\ \text{yd}^2} = 160\ \text{yd/d} = 480\ \text{ft/d}$$

Assume: 60-day composting period
20′-gap between piles
15′-driveway between windrows

Total daily length = 480′ + 20′ = 500′

Total length on plant site = (60 days) (500 ft/day) = 30,000 ft

Area per foot or windrow = (10 + 15) (1) = 25 ft^2/ft

$$\text{Total windrow area} = \frac{(25\ \text{ft}^2\text{/ft})\ (30{,}000\ \text{ft})}{(43{,}560\ \text{ft}^2\text{/acre})} = 17.2\ \text{acres}$$

Add a 60% safety factor = 10.2 acres = 10.2 acres
Add area for buildings, etc. = 2.5 acres

Total area required 30.0 acres

OPEN DISCUSSION: PANEL B

Abraham Michaels,[*] *Panel Chairman*

Mr. R. R. Dalton[†]: What do you know about tepee burners with afterburners?

Mr. Elmer R. Kaiser: I had a paper in the *American Public Works Association Yearbook of 1960* in which that point was discussed. I made calculations at that time and as I remember it takes about 125 or so gallons of oil to heat the flue gas from a ton of refuse burned in the tepee unit to 1,500° F for the afterburning effect. Now, that's entirely too much oil. The reason there is such a high excess of air, 400 or more percent is to protect the tepee and not burn out the screen at the top. An afterburner is only useful when you can keep the excess air quantities in a low range. And then, I dare say, if you do that, you would need a refractory furnace, and you would get enough temperature automatically without the afterburner. Therefore, they have had to go to the scrubber concept in order to clean up the flue gas.

Mr. W. Harrington[‡]: What percentage of the total refuse quantity as delivered is finally converted to compost?

Dr. Charles I. Harding: Let's take that on dry solids basis, because I think we are going to have to ultimately get to that. If you take refuse received in a plant, it is about 25 percent moisture. Then about 80 percent of this material (possibly with good film plastic and artifacts removal, 65 percent) will go to the digester.

There is about one-third loss in the digester of the material going in. Thus, on a dry solids basis you would come out with about 30 percent of the dry solids delivered to the plant as product. If you sell it at 100 percent moisture on a dry solids basis, then you are going to have about 60 percent of the material delivered to the plant which would be product by weight. By volume it would be much smaller; the density received from packer trucks is somewhere around a low of 10 to a high of 20 pounds per cubic foot and the compost is sold from 32 to 40 pounds per cubic foot. So there is a marked volume reduction in the material.

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[*] Consulting Engineer, Philadelphia, Pennsylvania.
[†] Russell R. Dalton, Alexandria Health Department, Virginia.
[‡] William M. Harrington, Whitman, Requardt and Associates, Baltimore, Maryland.

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Mr. Harrington: I am quite interested in the percentage as delivered that actually gets converted. I don't care what the end product is. But if you get 5 tens, how much of that on a dry solids basis, or however you want to put it, how much of that do you actually compost? Because you are salvaging, you are getting rid of your plastic and some of your paper.

Dr. Harding: Of the material that *enters* the composting process? About two-thirds.

Dr. G. C. Szego*: How about burning by using natural gas jets buried by the rubbish being combusted?

Mr. Bowerman: This is a process that comes up for consideration from time to time because "in-place" burning sounds as though it might be really cheap, and maybe an efficient way of getting volume reduction. The one attempt that I am personally familiar with was done in the San Francisco area on buried demolition wastes with an earth cover. An attempt was made to control the combustion process, but frankly, the manner in which you can control an underground burning operation is rather limited. You don't have many controls, once you ignite the solid wastes. You're pretty well at the whim of the way it was put together, and if that wasn't quite right, then there's nothing much you can do about it. In this one instance, the operation seemed to start off fairly well. Then it started smoking, and the smoke brought the fire department: the fire department hosed down the earth cover and made holes in it. The whole thing then went up in one grand debacle.

A controlled burning operation was tried on a much smaller scale at one of the Los Angeles District sanitary landfills. We built a pyramid, about 20 feet high and provided open space on the bottom by putting in a bunch of palm-tree logs, crisscrossed. The rubbish pile was placed on top of that, and an earth cover placed on top to create a virtual Vesuvius. A hole was left in the top for a chimney, and the material was allowed to decompose aerobically. Eventually it spontaneously combusted and burned so well that it was still burning about three months later. It just doesn't appear that under these field conditions you can hope to get the type of combustion that's going to meet air pollution control standards.

Mr. T. W. Bendixen†: What will incineration do to reduce oxides of nitrogen, when air pollution control authorities require control of nitrogen oxide?

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* Dr. G. C. Szego, Inter Technology Corporation, Warrenton, Virginia.

† Thomas W. Bendixen, U.S. Public Health Service, Cincinnati, Ohio.

Mr. Kaiser: In the example I gave you, the nitrogen oxides were 93 parts per million. We get less nitrogen oxides in incineration than they do in the burning of coal or oil in power boilers. The reason is that we operate at lower temperatures. In the first place, our fuel has more moisture and inerts, which take up heat; secondly, we try to stay below 1,800° F in the refractory line units, in order not to have the ash form slag on the walls. And that is a big help in holding down the nitrogen oxides. What to do about them to get a further reduction, I certainly don't know. Whether the water spray treatment that we often give the gases afterwards will take some of it out, I am not sure either. But certainly with stacks that extend 200 to 300 feet high, the dispersion of that little nitrogen oxide is not going to be any problem. That subject is being researched in connection with the big oil- and coal-fired power boilers, and after they work it out, perhaps we can adopt something if that is still necessary.

Mr. Ward Barstow*: How does the quality and quantity of refuse in Europe differ from that in the United States?

Mr. Robert D. Bugher: It's difficult to generalize on that kind of a question. I can say this: Last month Abe and I had the pleasure of attending the Ninth International Public Cleansing Association meeting in Paris. James Sumner of Great Britain presented a paper which summarized the characteristics of waste in different countries. As I recall it indicated that the percentage of organics in the northern countries was in the neighborhood of 20 to 30 percent, but one of the striking things that I recall was that some southern countries, particularly Israel, reported that their percentage of organics was as high as 70 percent. The percentage of paper obviously is much greater here in this country. They are much more thrifty in Europe and do not produce as much waste. I asked this question of one gentleman from England and he told me that their refuse is becoming more like ours — they are getting a lot more paper. He also indicated that the quantity and quality of their wastes is similar to what ours was about 20 to 30 years ago. Incidently, if you want more specific information on this question we will be glad to make it available.

From Audience: I'd just like to ask if you don't consider paper as organic; it composts perfectly well.

Mr. Bugher: When I use the term organics, I mean mostly vegetable wastes, i.e., putrescible organics.

From Audience: I think the paper and the organics would be considered one, don't you, along with leather and anything else which is organic, anything which will compost?

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* Ward Barstow, State Department of Health, Baltimore, Maryland.

Mr. Michaels: Yes, it's true. The amount of paper certainly affects the carbon:nitrogen ratio which affects the quality of the compost. The numbers (paper percentages) that I remember that are significant are that in Europe about 30 percent of the refuse was paper, whereas in the United States paper or paper products are over 50 percent. I think this represents the significant difference between the two types of refuse.

Mr. Wisman: Why, if you believe in recycling metals back to industry, do you not believe in recycling organics back to the soil which feeds us and which we are depleting?

Mr. Kaiser: Personally, I intend to remain objective about such matters. If the compost people can develop their processes and a market for the product, more power to them. Refuse not disposed of as compost will be incinerated and landfilled. I happen to specialize in incineration, which takes all of my time, which means I can only try to encompass that much of the field. If there is also a place for compost, the judgment as to its future must be made in the marketplace.

Dr. Harding: We have been working with some pretty sharp agricultural people and they tell me (although I'm not a farmer and I couldn't grow anything if I had to) that if you want to show a net increase in organic content particularly in a sandy soil, you'd have to put into the top two inches of the sandy soil each year a six-inch layer of compost. So this is somewhat of a myth — that you're going to increase the organic content of the soil by adding compost to it. It sounds good, and that's what I referred to at the very beginning — it's a romantic idea that really appeals to people. I don't want to play it down, but I want to be realistic about it. We aren't going to increase the organic content of our soils which we are depleting, materially in this way. In my opinion, the way composting has a reasonable chance of success is by courtship and marriage with the fertilizer industry. There is now a big move to use organic fillers in fertilizers. Compost has rather low nitrogen and so it doesn't compete very well with waste-activated sludge; but I think the future of composting on a bulk, large-scale basis, is intimately involved with the future of the fertilizer business. In that way I think there will be some recycling.

Mr. S. Ehrlich[*]: When do you expect the slag-tap process, which you touched on, to become commercial? Could you briefly give us more details?

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[*] Shelton Ehrlich, Pope, Evans and Robbins, Alexandria, Virginia.

Mr. Kaiser: Taking up a few details first — the slag has a density of about 2.4, which is about the same as glass. I have measured the density of this material — if you could cast large chunks of it and bury those, you would get up to this 3,000 to 3,800 pounds per cubic yard. However, if it is run into water it breaks up into a black, glassy sand. So there are voids. The slag sand would have a density of approximately 2,500 pounds per cubic yard. If you have a mixture of chunks and fines you will have an intermediate density. When will this become commercial? I can't predict that. More demonstration work must be done on it and studies made of it. In Europe at the Volkswagen Works they have had a slag-tap operation for quite some time. In regard to the Melt-Zit process in Massachusetts, there will be some tests a little later this year.

Anonymous: What progress can be reported in the problem of making beer (and other disposable) cans from early-deteriorating materials?

Mr. Bowerman: Well, my good friend, Dr. McGauhey of the University of California, Berkeley, says that the ideal container is the ice cream cone. Maybe someday somebody is going to come up with a container for beer that's edible, but I think that in the meantime the transition will be from a metal to a fiber; I think we'll find that we cannot afford to use our mineral reserves in a non-conservative manner, and go over to fibers where we can grow and regrow and continue to grow new resources indefinitely. Thus, I think that we'll see more fiber containers and less metal.

Mr. Michaels: Actually the container industry is probably the one industry that is more responsible for the predicament we are in today than any other industry. All reports that I have heard are that they have no intention at the present time of concerning themselves with the waste disposal problem; that, in fact, their job is to sell more and more containers. Hopefully, they will come up with something that will be degradable but as of now I don't think there is any indication that the industry contemplates changes that will significantly reduce the refuse disposal problem.

Anonymous: Why are not private utilities, that is, electric and gas and particularly electric, regulated as closely as other industrial entities on waste disposal?

Mr. Michaels: I don't know that this is so, necessarily. Certainly, recent legislation in New York City and legislation in other major communities which set limits on air pollution emissions, indicates, considerable control of public utilities; I don't know whether anybody else in the Panel or in the audience has any comments to make on this . . . I'm inclined to feel the premise is not a correct one. Any comments at all?

Mr. Kaiser: In New York City we have a large enough area, and burn so much fuel of rather high sulfur content — heavy oil and coal, 2 to 3 percent sulfur — that sulfur dioxide in the atmosphere is a definite problem. We are said to be the nation's worst in that respect. And so legislation has gone in to reduce the sulfur content of these fuels. Now, it's hard to get that kind of fuel, and it will be at a higher price, of course. You notice from the analyses that refuse is extremely low in sulfur. In fact, I say without hesitation, that we have in refuse "the sweetest fuel this side of natural gas." That's true! So, if we would burn refuse and generate power there, we would need that much less of the higher-sulfur fuels, and thus, in a sense, help ourselves to a degree, only because of the tonnages involved, in reducing the content of SO_2 in the atmosphere. On the matter of fly ash, I think we can reduce our dustloadings as low as is done with the coal fire boilers. There is a move underway, therefore, to build a big refuse burning plant in the old Brooklyn Navy Yard. It would generate steam, send that steam to Con Edison, a big electric utility, which has distribution mains in the streets for district steam. Con Edison says that refuse could be used to generate steam for district heating — as, of course, is done in Europe. And, I think behind that question, is the thought that a marriage there could help the community. Instead of everybody going his own independent way, if we can work at these things together, again as they do abroad, it should help the overall picture.

Mr. Michaels: Thank you. I would like to make one observation with respect to the use of refuse as a fuel. One of the things that I did when I was in Paris was to present a paper on incineration without waste heat utilization. I had occasion to determine the relative heat value available in refuse throughout the United States, and compare it to the heat value of the fuels currently used for power generation, or for all energy, as a matter of fact. As I recall, if all of the refuse were converted to power, to energy, we would provide somewhere on the order of 2 percent of the energy that the nation is currently using. If we took the energy that goes into automobiles and other modes of transportation using self-powered vehicles, this would provide somewhere on the order of 5 or 6 percent of the heat value required. So, even if all of our refuse were converted to energy, the best we could do is reduce the air pollution effect by this 5 or 6 percent. Which, of course, is the approach that we take; that is, that we nibble away at these problems: we don't attack them and solve them by changing our way of living overnight.

Mr. Kaiser: Because the quantities are so great, even that percentage is quite substantial.

Mr. Michaels: Well, that's the point.

From Audience: Did you figure what percent of energy coal supplies at the present?

Mr. Michaels: The total energy output in the United States was considered in this study. This includes, coal, fuel oil, natural gas and even the small amount of atomic energy that's currently used.

Dr. Harding: I think that the argument, if you want to use an argument for combined power generation and refuse disposal, is this. As was pointed out very efficiently by the luncheon speaker yesterday, cities, most municipalities, do not give adequate attention to incineration operations. In my opinion, electrical generation facilities are some of the best-run operations in the country. If we then have a combined refuse disposal and electrical generation system under the control of the utilities system, I would think that we would have much more efficient combustion and much better disposal of refuse.

Mr. Michaels: That's a very sound observation; I agree completely.

Mr. Hall: Is there any hope of early solution to incineration and reduction of scrap and junk automobiles? My particular interest is the elimination of open burning of vehicles in volumes up to 40 to 50,000 cars per year.

Mr. Kaiser: A study was made a few years ago with Public Health Service funds on the smokeless burning of automobile bodies in closed furnaces. Copies of the report are available from my office. You can also obtain a set of plans for a unit that would burn up to 28 auto bodies a day, if you send me $5 in a check made out to New York University. We have sent out about 150 sets of those plans. There have not been that many units built, but the principles have been well demonstrated. There are automobile incinerators in this country that burn up to (and there is only one at this size which has been operating since 1959) 400 auto bodies in eight hours. It is in Brooklyn. At the moment, or at the last I heard, they were operating above 300 cars per 8 hours only for the reason that their baling press was able to handle only that many while making a small bale, which the present market calls for. When they made the larger bales they could burn at the 400-car rate. Burning in the open produces voluminous black smoke. By burning in a closed unit with an afterburner to burn up that smoke, you can have virtually a clear stack and a satisfactory operation.

Mr. Michaels: Actually, incineration or burning of cars is not the only way of handling this waste product. Frank Bowerman has had some experience out on the West Coast with another device. Will you tell us about it, please?

Mr. Bowerman: Yes. Interestingly enough, in the western part of the United States abandoned automobiles are disappearing. The reason is that a nonburning process has been developed. Two very large companies are working with this process. It's strictly a grinding process, but the unit is so large that the grinders can take an entire car body and knock it down to sizes of metal about as big as your fist. The radiator is removed for its copper value. The gas tank is removed, so that it won't explode. The engine is removed. The normal stripping required before you burn a body so that you get, the copper wire, upholstery, and similar things out, isn't necessary. Once the parts with a higher value are removed, the rest of the car body simply drops down into a monstrous grinder and comes out the other end as relatively small chunks of metal with the paint largely knocked off. The debris is easily separated out on a screen and sent to landfills. The hunks of metal are baled and are going overseas.

Mr. Michaels: I think that the manufacturer of the third unit might be upset if he heard you refer to only two of them. There are several companies producing this machine.

Mr. Charles Kenahan*: Why are you so certain that metal salvage is not feasible or profitable? Because nobody has designed or devised a system for recovering metal from refuse or residue? At the same time you have great confidence in composting, which has failed after many attempts.

Dr. Harding: That's a good question. Tramp metal or regular scrap, either ferrous or nonferrous, if you are going to hand separate it, does have an outlet through the regular scrap brokers. In our attempt to abbreviate the comments, I left out much of that information. That can be handled. The thing that is the big headache is the tin cans; this is the metal that I am referring to which has the limited market, based on comments from scrap dealers, such as Sam Proler with Proler Steel in Houston, and other people with the secondary materials industries. They just seemed to think that cans do not have a future, unless you can develop export markets, or unless you are geographically close to the copper mines. As far as the composting goes, I think that the fertilizer people are looking for reasonable quality organics. And if the compost operation is a combined sewage disposal and composting refuse disposal facility, if properly operated it can provide a bulk organic reservoir for fertilizer.

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* Charles B. Kenahan, U.S. Department of the Interior, College Park, Maryland.

Dr. A. Viehoever*: What is the most effective method of disposal of plastic refuse? What is the most effective temperature without gumming? What are the prominent combustion products of polyethylene plastics?

Mr. Kaiser: That's an easy question. Polyethylene is a carbon-hydrogen compound. It's a beautiful fuel. Sure, it will get gummy if you've got a lot of it and you're trying to ignite it all at once. But in the refuse, as it normally comes where it is only one or two percent, it burns nicely. It will burn clean to carbon dioxide and to water vapor. It's the polyvinyl chloride which gives us hydrochloric acid on burning, or chlorides. PVC is used in the insulation of copper wire, where it is compounded with a number of metallo-organic compounds. On burning the wire, zinc chloride, mercuric chloride, aluminum chloride, titanium chloride, and so on are produced and probably some free hydrochloric acid. In refractory lined equipment, that isn't a problem. But, when the chlorides come in contact with metal equipment, such as fans, and cyclones, and boiler tubes, then we can have a problem. We are observing some trouble that way. The fortunate thing is that to date, the percentage present in refuse is very small. If more and more polyvinyl chlorides are produced, then my recommendation would be to take it out and bury it!

From Audience: What effect does it have on the public when these gases come out?

Mr. Kaiser: Again, we are saved by the dilution in the atmosphere. A scrubber, however, does take it out. We have burned copper wire alone in tonnage lots. The chlorides in the combustion gases are removed readily by means of a scrubber They are soluble in water, and are taken out effectively by scrubbing.

Anonymous: No incinerator today is meeting air pollution requirements.

Mr. Michaels: I don't think that is a correct statement.

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* Arno W. Viehoever, Viehoever and Campbell Associates, Oxon Hill, Marylnd.

THE NEED FOR LONG-RANGE PLANNING FOR A SOLID WASTE DISPOSAL PLAN

Paul M. Reid *

It is a distinct pleasure to meet in Washington on a *metropolitan* rather than a *national* basis. We don't often have the opportunity to meet for the purpose of facing common problems of metropolitan regions. It is gratifying that the Detroit region's experience in developing a long-range plan for solid waste disposal is called upon here to aid in the metropolitan Washington situation. I have responded to the call, not as an expert who knows all the answers but does not understand the questions, but rather as a practicing planner, persistently perplexed by the continuation of pertinent and sometimes impertinent questions regarding solid waste disposal. Let me at the outset confess our progressive sophistication in the use of the concept "solid waste." We started out in the Detroit region being concerned about disposal of *garbage and rubbish*. By the time we completed our plan, we called it *refuse disposal*. And now, we have adopted the terminology of the Public Health Service and the environmental health engineers — *solid waste disposal!*

In pursuit of rapport, let me check off quickly some helpful comparisons between metropolitan Washington and the Detroit region. In common with all such urban areas in the nation, both are beset by growth and expansion problems that not only override jurisdictional boundaries but also constantly tend to change the content, character and conformation of each unit of government involved. The Detroit region in 1966 contained an estimated population of 4,359,000; Metropolitan Washington had 2,600,000 people. Both have a significant background of metropolitan-regional planning, and both pioneered early in intergovernmental cooperation. In our area, the Supervisors Inter-County Committee dates back to 1954; in the Washington area, the Metropolitan Regional Conference was formed in 1957. The economies of the two areas differ, the Detroit region having a larger share of its employment in manufacturing and the Washington area having a heavier portion of its employment in government services. Both areas are still engaged in transportation studies of critical consequence. In the Detroit region, we have developed a regional recreational lands plan, while here in the Washington area, progress is being made on a regional open space plan. Both areas are deeply concerned in a metropolitan solution of

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* Executive Director, Detroit Metropolitan Area Regional Planning Commission.

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the solid waste disposal issue. The metropolitan Washington area has successfully established a Council of Governments, while in the Detroit region the final phases of a six-county Council of Governments are now being undertaken.

Detroit Region's Approach to Solid Waste Disposal Plan

Six years ago, an *ad hoc* committee of supervisors from our then five member counties recommended that our regional planning agency place more emphasis on facility planning. Garbage and rubbish disposal stood high on their list of urgent priorities. Our Supervisors Inter-County Committee — which is made up of representatives of the six southeastern Michigan counties of which the Regional Planning Commission now embraces four — not only supported this recommendation, but offered to take a major part in the implementing of a regional refuse disposal plan. This background for our work is important. It reveals that local and county officials stressed the need for such a study and plan. It also insured that at the outset the Regional Planning Commission had intergovernmental support for the project. In contrast, our planning agency for some years had cited the need and urged that funds be provided for a regional transportation study, with emphasis on mass transportation and trucking, but got little response due to a lack of feeling of need among officials and government agencies. It took the Federal Aid Highway Act of 1962 to arouse local and county officials enough to launch this needed project.

As wisely provided in our planning agency's Rules of Procedure, once the need for a refuse disposal study was realized and support was forthcoming, we set up a large technical advisory committee of local, county and state officials, planners, engineers, and sanitation people to counsel and assist our staff in this project. These people were unhappily aware that the collection and disposal of solid waste in the Detroit region was on a makeshift basis. They recognized that steps of expediency only tempered the current anarchial situation and that chaos was the ultimate result unless an organized, area-wide approach were developed to handle the mounting problems of the efficient collection, transport, and sanitary disposal of solid waste. We all agreed that in our urban areas the key feature of the solid waste disposal problem is that it is intergovernmental. Hence, its resolution must be at the intergovernmental level. A common recognition of the extent and mutuality of the problem among officials of the beleaguered units of government is a primary step in setting up the apparatus for attacking the problem.

A project work program was developed and finally passed muster for a Section 701 planning assistance grant from the then Housing and Home

Finance Agency. The project was questioned at first by some HHFA officials as merely a "housekeeping" study. We anticipated, however, that the sanitary disposal of solid waste would require large areas of land, and that such land use would have to be related to other land uses, now on the ground or anticipated. Further, we saw the opportunity and potential for the reuse of sanitary landfill areas as park facilities, on a local, county or even regional basis. Thus, we finally convinced the HHFA people of the value and cogency of our project.

Our planning agency employed a professional engineer to direct the study and established him in the position of Deputy Director for Facility Planning. We were smart enough to recognize that as planners we had neither the technical skills nor the experience to handle the engineering aspects of the study and plan.

Most of the basic information was obtained from a mailed questionnaire, with some follow-up, of course, and from field surveys of existing and potential landfill and incinerator sites. The findings of this survey work fortified and dramatized the sense of need that had instigated the study.

Indicators of Need

The measure of need for an area-wide solid disposal plan and operation is highlighted, we found, by the size and scope of solid waste materials to be handled. The amount of garbage daily accumulated by the average family in a metropolitan area has been increasing, in spite of the prepackaging of prepared foods and some increase in the use of home garbage grinders and incinerators. The raising of living standards tends to affect both the quantity and character of garbage. In regard to rubbish, we found in the Detroit area that communities with a higher economic level also tended to produce more rubbish per household. The average family in our area accumulated about 1.5 tons of garbage and rubbish per year. This was exclusive of demolition materials rubbish, resulting from the razing of houses and buildings in the course of residential and commercial redevelopment, and freeway construction, and also exclusive of major industrial rubbish. And the Detroit region has been growing at the rate of about 18,000 families per year! That means 27,000 *more tons* of solid waste per year!

Another vivid index of need that we uncovered was the alarming short-range capacity of existing disposal areas for solid waste. Out of 149 units of government responding to the question of length of future life of their landfill sites, this is what we discovered:

Forty-five answered: 3 months to 10 years. Of these: 30 had 2 years or less; 15 had 3 to 10 years; 15 said that they had sites for 10 or more years; 85 did not know how long their sites would last; 4 said their sites would last for an "indefinite" period. To put it bluntly, only 15 out of 149 governmental units reported they had landfill sites expected to last 10 years or more. For the overwhelming majority, their provisions for solid waste disposal were either dangerously short-range or nonexistent.

Our survey revealed that 82 of the 178 units of government (cities, villages and townships) that had collection systems were disposing of their solid wastes outside their own borders, within the territory of another unit of government. There is an ironic rationale in this situation. We *import* into our communities — largely from far-distant places — much of the material that produces our solid waste: food in tin cans, glass jars, and paper containers; liquids (*alcoholic and nonalcoholic, like milk!*) in glass bottles and paper containers; paper sacks, cardboard boxes and wooden containers resulting from the purchase of a variety of personal, household and clothing items. Then, each community in the urban complex seeks to *export* these refuse materials to another nearby community that has a handy landfill or convenient dump! The staff got to calling our regional map of origin and place of disposal of refuse the "worm map." The worm lines often ran from four communities to a fill site in one community. Or a single community might export its solid waste to three or four communities.

The range of prices that private collectors charged to units of government and to private households and business for collection and disposal of their solid waste was still another indication of a crying need for a region-wide system. Since our report and plan were published in early 1964, there has been a series of rises in the contract prices of private haulers in the Detroit region. Some of these collectors have gone out of business for want of disposal areas within economic distance of their customers. In most cases where the community took over from private contract collectors and instituted a public collection system, costs went up. Several individual local units of government took steps toward construction of their own incinerators, planning to build them with large enough capacity to accommodate the needs of adjacent communities — at a price that would help pay off the incinerator costs, of course.

Still another pressing need factor was consistently confirmed by our regional survey. The expanding rings and stub arms of urban growth into rural townships and undeveloped territory forced the location of disposal sites farther and farther from the more heavily populated central parts of the region. Economicwise, this meant higher and higher haulage costs to both private contractors and municipal collection and disposal services. Trafficwise, it meant heavy refuse trucks were wearing out minor and only semi-improved roads giving access to these rural disposal sites. The pattern of small disposal areas spread farther and farther out, due to expediency and the lack of an area-wide plan.

Results of Survey Study

Our staff and technical advisory committee developed some very definite convictions on the basis of our intensive study of existing conditions regarding refuse disposal:

(1) Only a region-wide, long-range plan put into effective operation could provide a solution on the basis of sanitary disposal, economy, and rational land uses.

(2) Disposal by a combined system of incinerators — located at strategic sites in the region — and sanitary landfill sites, also properly located, was the most effective method. We recognized that both incinerators and sanitary landfill sites were needed. Neither alone could serve the needs of the region. The ash residue from incinerators required disposal in sanitary landfills. Not all rubbish or refuse could be put through an incinerator, such as, bricks and stone from buildings. The cost of putting all garbage and burnable refuse through incinerators and depositing only the resulting ash in landfills was deemed too great. In addition, the use of sanitary landfill sites by the outlying low-density population and rural areas was entirely feasible, until they attained significant urban densities. Hence the five-county region was divided into a core area of population concentration and outlying sectors of sparse population, with the incinerators to handle a significant part of the burnable solid waste from the central core area of three of the five counties. In addition to two large sanitary landfill sites to serve the core area (one until 1980 and the other beyond that date), a number of small sanitary landfill sites were selected and spaced in the outlying areas. Both of the major landfill sites are worked-out gravel pit areas. The No. 1 site for the period to 1980 has pits of 90 feet in depth, dry, with ample adjacent cover.

(3) We proposed that collection and transfer stations be constructed at selected sites in the core area, and that rail transport by means of vans on flat cars be utilized to get the solid waste and incinerator ash to the major landfill site. (In the course of our study, I visited and examined your transfer station here in the District, and was very favorably impressed.)

(4) We recommended that a metropolitan service agency be established to run the operation in the core urban area and that existing county agencies (road commissions and departments of public works) carry on the sanitary landfill services in the outlying areas.

(5) To back up our recommendations, we hired a well-established midwest firm of consulting engineers to develop basic data on costs and financing of the two alternative plans. One plan put a heavier emphasis on incineration, requiring some additional plants, the other depended on the existing plants and put more emphasis on sanitary landfill operations.

In line with our concern (as planners and conservers of natural resources) for the reuse of sanitary landfill areas, we employed a firm of landscape architects to develop a series of sketches to show how both large and small sanitary landfill areas might be developed in a variety of parks for different types of outdoor recreation. Since the publication of our report, a private recreational enterprise has taken steps to use solid waste to build ski runs!

Implementing the Plan

As soon as our report was off the press, we made a full-dress presentation to the Supervisors Inter-County Committee. On the basis of this report, that body at once urged its member counties to examine the report carefully and then begin to develop the necessary steps of implementation. In time, all five counties involved had special committees of their Boards of Supervisors at work on this matter.

The Metropolitan Fund, Incorporated, our voluntary regional research agency, was deeply concerned with implementing a regional refuse disposal plan, and underwrote $12,000 for the production of a series of scale models of the plan, for use in informing citizens and local officials as to its need and workings. These models include an incinerator, a transfer and loading station, and a sanitary landfill operation, with a huge contour map of the region in the background of the display. The models have already been displayed in four of the five counties and at a local chapter meeting of the American Public Works Association and at the National League of Cities Conference in Detroit. They will be further utilized throughout the five-county area, at county seats and in the various cities and townships.

I have here with me copies of the brochure, explaining the waste disposal models, which are distributed when the models are displayed.

As a further step in implementation, the Metropolitan Fund — at the request of the Supervisors Inter-County Committee — undertook a legal study of just how to set up a regional solid waste disposal authority. Under our new constitution, the establishment of such metropolitan service authorities is permitted, but enabling legislation by the state lawmakers is required for this end.

Our legislature last year, the first one under the new constitution and redistricting, passed a law to license and regulate garbage and refuse disposal. Several of the members of the advisory committee that assisted in our study are on the State committee set up by the State Health Department to write the standards and regulations for sanitary landfills.

At this stage in the long drawn-out and often frustrating implementation process, probably the major point to be made is that at least communities and officials are thinking on a county basis, instead of a local civil division basis. Some of our counties are willing to make an inter-county approach, but not all. But we are moving, and in the right direction! We have also had an assist from the Solid Waste Program administration in being requested to review applications for demonstration grants in our region.

What would we have done differently? Make no mistake, we would have done it again!

(1) But if we had to do it again, at the outset we would seek to put the project of developing the study and the plan under the aegis of a region-wide policy body. You have such a body; your Council of Governments is just the instrument. Our Supervisors Inter-County Committee was helpful but not equal to the tough task of effectuation. I expect our new Council of Governments will attain such a position.

(2) I would seek for the project the joint support of the Department of Housing and Urban Development and Department of Health, Education, and Welfare for the undertaking. Both Federal agencies have a stake in the development and effectuation of a region-wide solid waste disposal plan — one from the planning and land use standpoint, the other from the environmental health standpoint.

(3) Another urgent step to add would be the formation of a citizens' advisory committee to work parallel to the technical advisory committee. Elected officials need the push and the informed support of a significant body of citizens to achieve legislation and financing.

(4) And finally, I would add to the technical advisory committee — of engineers, environmental health people and planners — representatives of recreational agencies — regional, county and municipal. They should have

a part in the development of plans for the recreational reuse of sanitary landfill areas.

Conclusion

One of the unanticipated by-products of our study and work on a regional solid waste disposal plan has been a better understanding among urban planners, environmental health engineers, public health and public works officials. We had worked together before, sporadically, on little things here and there. In this case, it meant some intensive work on a big project with rather serious implications. It has created a better environment for professional cooperation in the interests of sound and healthful metropolitan development.

ADMINSTRATIVE PROBLEMS IN THE REGIONAL APPROACH TO SOLID WASTE MANAGEMENT

Ross L. Clark *

THIS IS CENTENNIAL YEAR IN CANADA – the passing of one-hundred years having taken place since Confederation in 1867. Celebrations are underway in the many communities of our ten Provinces for the 20 million persons resident in the land, to focus attention on accomplishments, shortcomings and historical events which have brought the country to its present state of progress.

The various activities are permitting the citizens to reflect on traditions of the past, and to pause and assess the many problems — social, environmental, physical, and others — which must be met as we enter our second century.

The nation's birthday is highlighted by EXPO in Montreal, where the peoples of the world have recorded in steel, concrete and technical-social presentations, the great symbols of progress and the many wonders of the 20th century, to conform with the theme of the Fair — *Man and His World.*

Man's environment is constituted from the three traditional elements mentioned frequently in Greek writings and mythology, namely land, water and air. It would serve little purpose to explore the relative importance of each, for all play a significant part, and are essential to the existence of life. Indeed, it was the very presence of these ingredients which brought the early explorers to Lake Ontario, and provided them with plentiful agricultural and forest products, transportation and a healthy atmosphere.

Growth and development came quickly, and by 1849, when the city was incorporated, the population had reached a level of 9,000 persons. Today, — after the passing of 120 years — our citizens in the core City of Toronto and its environs number some 2.5 millions.

The Municipality of Metropolitan Toronto is a relative newcomer to the Canadian scene. However, in the brief period of 13 years, it has attracted widespread interest because of its governmental format, and in the considerable success achieved in overcoming many of the regional problems associated with the burgeoning growth of urban complexes.

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* Commissioner of Works, The Municipality of Metropolitan Toronto.

Metropolitan Toronto is a federation of the central core City of Toronto and its surrounding suburbs, embracing 240 square miles and 1,850,000 people within its environs. The municipality was originally constitued in 1953 through enactment of Provincial legislation following a comprehensive study of the municipal problems in the Toronto area, by the Ontario Municipal Board — a body charged with responsibility to control capital expenditures by municipalities in Ontario, and which also exercises certain powers in planning, zoning, and other related matters.

The O.M.B. as it is more commonly known, received arguments pro and con by the city and each of its suburbs, on the suggested amalgamation of the entire area under one government, and the Hearing culminated in a recommendation that a new level of government be instituted in which the city, and its suburbs, would become partners for certain purposes.

Originally the Metropolitan Council was composed of 12 representatives from the city, and the mayors or reeves of the 12 suburbs. Mr. F. G. Gardiner, Q.C., L.L.D., was the original chairman, initially appointed by the Province for the first year, but subsequently selected for reappointment by the Council members. He retired in 1962, and his successor, Mr. William R. Allen, Q.C., was chosen by his colleagues from their ranks, and has been returned to office at each annual inaugural Council Meeting since that time.

The new Council was charged with defined responsibility for: uniform assessment; financing; water supply; sewage disposal; arterial roads; public transportation; welfare (certain functions); capital costs of education; administration of justice; housing; regional planning; and parks.

The member municipalities retained considerable autonomy and assumed responsibility for local services such as: distribution of water; operation of sewers; local streets and sidewalks; schools; fire protection; district parks and recreation; garbage collection and disposal; street cleaning; snow removal; libraries; local planning, etc.

In 1956, police, licensing, air pollution control and civil defense were integrated as regional activities.

Typical of the accomplishments of the Regional government in its initial years are: expansions of the water supply and pollution control facilities, with expenditures in excess of $200,000,000*; a rapidly developing system of expressways and arterial roads, costing over $365,000,000[*], generally financed 50 percent by the Province; extension of the rapid transit subway system into the eastern and western suburbs at a cost in excess of $200,000,000, partly financed by the Province; ever-increasing investment in schools (current requests are $30 to $50 million a year); similar expansions in parks, recreational and conservation lands and buildings, as well as housing for the aged, and low-rental accommodation.

During the period from 1954 to 1966, refuse disposal remained the responsibility of the member municipalities and the private and industrial concerns involved. Metropolitan Toronto did operate, through its Department of Works, sanitary landfills at a number of locations, partly to provide a needed service at a cost, but also with an end result in view — usually the transition of low-lying, wet or swampy areas into useful parks, although, in at least one case, selected fill was utilized to reduce the degree of slope on a high bank behind private houses, where land slippage appeared imminent.

These operations had no official legislative status, and required a great deal of cooperation from officials, both elected and appointed, in the municipalities involved. In 1965, the time arrived, as a report prepared some ten years earlier had predicted, when there simply was no more land available within 'Metro' where operating procedures of the past seemed possible.

Several of the member municipalities, with inadequate or no incinerator capacity, found themselves approaching a state of crisis. The refuse disposal problem was one of the major concerns of a Royal Commission[†] investigating the Metropolitan form of government which had been appointed in June 1963, as a result of agitation by officials and citizens over certain inequities which began to develop in the government system originally established. Chief among them was "representation by population" — some suburbs, whose population was 15,000 or less, had equal votes on 'Metro Council' with those well in excess of 200,000, and the suburban population, absorbing most of the Municipality's annual increment of over 50,000 people, had grown to approximately 1,000,000, with the core city's population remaining relatively static at some 675,000.

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[*] This figure does not include expenditures made by member municipalities on local services.

[†] A Royal Commission may be appointed in Canada, either by the Federal or Provincial government, to explore whatever subject may be assigned under its terms of reference. Evidence is presented in the form of briefs and testimony, similar to a court of law. The government concerned may decide to follow the advice of a Royal Commission Report, or to accept only part, or none of its conclusions.

The Commission noted: "As locally operated sites in almost every municipality are quickly being filled, there is now an urgent need to locate new sites to provide disposal and incineration facilities on an area-wide basis." Reference was made to a brief presented by the Metropolitan Toronto and Regional Conservation Authority, which submitted that Metro alone should assume responsibility for all waste disposal. The Commission agreed, stating in its Recommendation 5 (vi): "The Metropolitan Corporation should assume responsibility for all waste disposal in the Metropolitan area." The Government of Ontario received the Commission Report in June, 1965.

During this same period, organizations such as the City Engineers Association of Ontario were endeavouring to impress government with the urgency of the waste disposal problem, not only in the Toronto area, but in the Province as a whole. Their advisory committee had prepared and published the following resolution in December, 1964, which is pertinent to this presentation:

> "Whereas the disposal of refuse, both household and commercial/industrial is a matter of growing concern and economic cost to the municipalities of the Province.
>
> "And whereas the cheapest method of disposal available at this time appears to be the sanitary landfill, the present economy of which is dependent on the availability and proximity of suitable sites, which in many areas are rapidly disappearing, or where available, their use may be objectionable to conservationists, or may become sources of pollution to water courses or to underground water supplies,
>
> "And whereas, at present, control of landfilling is under several Legislative Acts including the Conservation Authorities Act, Section 20 (1) (e), the Public Health Act, Section 6 (43), the Ontario Water Resources Commission Act, Section 26 (3), and under the jurisdiction of several provincial departments and/or commissions,
>
> "And whereas incineration, which appears to be the next most common method, also needs areas for disposal of residue and requires care to avoid excessive air pollution,
>
> "And whereas disposal of volatile chemical and industrial wastes is not entirely acceptable either in conventional sanitary landfills or incinerators,
>
> "Therefore be it Resolved that the City Engineers Association Advisory Committee to the Ontario Water Resources Commission requests the Commission to institute, or to investigate which provincial agency should institute studies into the long-range methods and economics thereof, for disposal of these types of wastes, as control would be preferable on a regional basis rather than on a limited municipal basis, and an effort should be made to centralize all regulation and control under the jurisdiction of one provincial agency."

A similar resolution was later forwarded by the Association directly to the Premier of Ontario.

In amendments to the Metropolitan Toronto Act introduced in 1966, the Ontario Legislature made significant changes in the Metropolitan Toronto format, creating 6 municipalities, into which the former 13 were absorbed. The land area remained essentially the same. The Council was expanded to 32 members plus the chairman to give more equal representation (20 from suburbs, 12 from city). Waste disposal became the responsibility of the Metropolitan Corporation after January 1, 1967, and all properties and equipment in use for disposal purposes as of March 31, 1966, were transferred without cost to the Corporation. The Act gave Metro authority to acquire land anywhere within the Metropolitan Toronto Planning Area (Metro area plus its continguous municipalities is 720 square miles), subject to the approval of the municipality in which the land is located, or, if such approval is not forthcoming, subject to a hearing before the O.M.B. whose approval is necessary, and who may impose such restrictions, limitations and conditions respecting the acquisition or use of such land as may be deemed necessary or expedient. The Act further provided that no fee could be charged area municipalities or their agents for their utilization of the regional disposal facilities.

On announcement of the foregoing terms of reference, Metropolitan Toronto engaged the consulting engineering firm of James F. MacLaren Ltd. in association with Black and Veatch of Kansas City to make an exhaustive study of the waste disposal problem, including: (a) the volumes and types of wastes collected now and forecast to 1985; (b) the need to equalize collection costs for each of the six member municipalities as much as possible by establishment of disposal points or transfer stations within reasonable haulage distances; (c) recommendations relative to the use of landfill, incineration, or a combination thereof; (d) the study and selection of sites suitable for these purposes; (e) consideration of special wastes such as sewage sludge, flammable and volatile liquids, construction demolition wastes, bulky objects, trees, leaves, street sweepings and catchbashin wastes, etc.

Mr. L. W. Bremser of Black and Veatch, who addressed your Panel A yesterday afternoon, will have dealt with these study factors in his paper on "Regional Solid Waste Study."

The recent report of the consultants recommends a blending of sanitary landfill and incineration methods and Metropolitan Council has approved inclusion in its five-year capital works budget of the sum of $31,800,000 to meet the needs of the area in waste disposal, for land acquisition, development of sites, and incinerator construction. At present hearings before the O.M.B. are underway relating to acquisition of a major site in a neighboring municipality. Planning and development of another site in one of the member municipalities is well advanced. These are expected to serve for upwards of ten years.

Another development affecting the picture involves establishment by the Province of a new branch of the Department of Public Health, and the introduction of amendments to the Public Health Act, bringing control of all sanitary landfill operations in the Province under that Department. A copy of Bill 71, containing the pertinent sections of this proposed legislation, is attached as a supplement to this paper. The effect of the Bill is to prohibit operation of any new landfills unless the following procedures are undertaken: (a) engineering studies as to possible adverse affect on groundwater, surface flow, and the soil; (b) preparation of engineering plans and specifications showing the projected development of the site; and (c) obtaining approval and certification of the Department of Public Health.

Provision is included for inspection of active sites, and for correction of any unsatisfactory conditions at the operator's expense, subject to court action and a fine of not less than $100, or more than $2,000 if convicted. A completed site may not be utilized for any other purpose for a period of 25 years without the approval of the Minister of Public Health. Regulations prescribing conduct of operations will be published later, under authority of the Act.

It is noteworthy, that perhaps as a result of the resolution by the City Engineers Association, the Prime Minister established an Advisory Committee on Pollution Control, composed of the following: *Chairman*, Deputy Minister of Energy and Resources Management; Deputy Minister of Agriculture and Food; Deputy Minister of Public Health; Deputy Minister of Lands and Forests; Deputy Minister of Mines; and General Manager of Ontario Water Resources Commission.

A full-time Secretary has been appointed to record activities and the Committee functions and reports to the Minister of Energy and Resources Management under the following terms of reference: (1) to ensure coordination of the activities of the various Departments of the Government responsible for pollution control; (2) to foster and coordinate technical and economic research of pollution problems; (3) to formulate training programs; (4) to establish technical subcommittees for the purpose of studying specific pollution problems; and (5) to make recommendations.

In the Federal and Provincial Governments of Canada, Departments of government are placed under the supervision of a Minister who is an elected official and a member of the Cabinet. He reports on all Departmental matters to the House. Administration of the Departments is performed by a Deputy Minister, who is generally an expert in the particular field, appointed to the post, and the senior civil servant in the Department. Thus, it will be seen that a very high-ranking Committee is bringing its attention to bear on the problems of coordination of activities in this vexing sphere of pollution control in Ontario, in which refuse disposal must be regarded as a major consideration.

Under the laws of Ontario, municipalities are the creatures of the Province, and are subject to extensive Provincial surveillance. Much of it is an aftermath of the depression in the '30's, when many municipalities across the globe declared bankruptcy. Today, no municipal council may commit its successors to future expenditure without the sanction of the O.M.B., which has an obligation to ensure that the debt structure of any municipality remains within the ability of its financial resources to repay. Additionally, because of subsidies from the Province in education, roads, welfare and others, controls in the form of audits, reports to the Department of Municipal Affairs, and a number of others are required. When the Provincial government passes legislation affecting municipalities, therefore, observance is required. Their only recourse is an expression of opinion at the polls at the next general election. In this manner, the opposition or unwillingness of some to cooperate in solving regional problems may be removed, while at the same time, consideration has to be given in planning works to eliminate or minimize the features which may have disturbed citizens, or caused their opposition.

The fact that, by simple passage of amendments to the Metropolitan Toronto Act, the Provincial legislature transferred all existing waste disposal facilities and equipment to metropolitan control, with no compensation necessary, other than assumption of any outstanding debt, thus giving effect to the Toronto regional approach, may not assist you here in the Washington area, under a different set of laws, even though circumstances and problems may be similar. You are far more familiar with your legislative procedures and problems than the writer, and perhaps only by comparison with our approach can the best combination of the two be made. However, irrespective of the advantages seemingly available in our legislation we have no lack of problems, both tangible and intangible. The protective clauses, written in our Act regarding use of lands in neighboring municipalities, enable aggrieved persons to call for an O.M.B. hearing, requiring presentation of all facts and aspects to justify the proposals. Irrespective of problems this is a healthy situation for in a democratic form of government, all sides have the right of expression, and we are not permitted to become so enthused over the obvious righteousness of our regional position that we are blinded to what our objectors may feel is the equal or superior righteousness of their case.

One thing stands out above all others. No matter how badly it is needed for the regional good, no sanitary landfill or refuse incinerator is welcomed with open arms as a prospective neighbor. Everybody agrees they are essential, as long as they are located someplace else. As administrators, we have to be conscious of this reaction and do everything possible to design our facilities to fit into their surroundings as pleasantly as possible, with housekeeping of the highest order, and prompt attention to, and correction of, any source of complaint. In this, conservation of the elements — our natural resources — air — water and soil — must be given paramount attention.

APPENDIX

WEATHER DATA	
Average rainfall per year	22.61"
Average snowfall per year	60.4"
Average yearly temperature	47.7° 71°
Average summer temperature (high)	80°
Average winter temperature	31° 19° (mean) during day high low

The Municipality of Metropolitan Toronto Act

PART IV-A

Waste Disposal

Interpretation

73a.—(1) In this Part,

(a) "area municipality" includes a local board ;

(b) "waste" includes ashes, garbage, refuse and domestic or industrial waste of any kind.

Waste disposal

(2) The Metropolitan Corporation may acquire and use land within the Metropolitan Toronto Planning Area and may erect, maintain and operate buildings, structures, machinery or equipment for the purposes of receiving, dumping and disposing of waste, and may contract with any person for such purposes, and may prohibit or regulate the dumping and disposing of waste or any class or classes thereof upon any such land, and may charge fees for the use of such property, which fees may vary in respect of different classes of waste, but no such fees shall be charged to any area municipality or its agent.

Approval re acquisition of land

(3) The power to acquire land under subsection 2 shall not be exercised without,

- (**a**) the approval of the municipality in which the land is situate, which approval may be granted upon such terms and conditions as may be agreed upon ; or
- (**b**) failing such approval or agreement, the approval of the Municipal Board.

Approval of O.M.B.

(4) The Municipal Board, before giving its approval under clause **b** of subsection 3, shall hold a public hearing and shall give or cause to be given at least ten days notice of the hearing to the clerk of the municipality concerned and to such other persons in such manner as the Municipal Board may direct, and the Municipal Board, as a condition of giving any such approval, may by its order impose such restrictions, limitations and conditions respecting the acquisition or use of such land as to the Municipal Board may appear necessary or expedient.

Powers of area municipalities

(5) On and after the 1st day of January, 1967, no area municipality shall exercise any of its powers with respect to the matters provided for in subsection 2 without the consent of the Metropolitan Council.

Assumption of lands for waste disposal

(6) The Metropolitan Council shall, before the 1st day of January, 1967, pass by-laws, which shall be effective on the 1st day of January, 1967, assuming for the use of the Metropolitan Corporation any land, building, structure, machinery or equipment, including vehicles used primarily for the disposal of waste, that the Metropolitan Corporation may require for the purposes of subsection 2 that is vested on the 31st day of March, 1966, in any area municipality and is used on such date for the purposes set out in subsection 2 or that is acquired by any area municipality after the 31st day of March, 1966, and before the 1st day of January, 1967, for such use, and on the day any such by-law becomes effective the property designated therein vests in the Metropolitan Corporation.

Sale by area municipalities limited

(7) No area municipality, after the 31st day of March, 1966, and before the 1st day of January, 1967, shall without the consent of the Metropolitan Council sell, lease or otherwise dispose of or encumber any property mentioned in subsection 6.

Extension of time

(8) Notwithstanding subsection 6, a by-law for assuming any property mentioned in subsection 6, with the approval of the Municipal Board, may be passed after the 1st day of January, 1967, and in that case the by-law shall become effective on the date provided therein.

Liability of Metropolitan Corporation

(9) Where the Metropolitan Corporation assumes any property under subsection 6 or 8,

- (**a**) no compensation or damage shall be payable to the area municipality except as provided in this subsection ;
- (**b**) the Metropolitan Corporation shall thereafter pay to the area municipality before the due date all amounts of principal and interest becoming due upon any outstanding debentures issued by the area municipality in respect of any property vested in the Metropolitan Corporation under subsection 6 or 8 ; and

(**c**) notwithstanding any order of the Municipal Board or any debenture by-law passed pursuant thereto, all amounts of principal and interest becoming due thereafter with respect to any debentures theretofore issued by the Metropolitan Corporation in respect of any property vested in the Metropolitan Corporation under subsection 6 or 8 shall be repaid by levies against all the area municipalities.

Default

(10) If the Metropolitan Corporation fails to make any payment as required by clause **b** of subsection 9, the area municipality may charge the Metropolitan Corporation interest at the rate of one-half of 1 percent for each month or fraction thereof that the payment is overdue.

Settling of doubts

(11) In the event of any doubt as to whether,

(**a**) any outstanding debenture or portion thereof was issued in respect of any property assumed under subsection 6 or 8; or

(**b**) any vehicle was used primarily for the disposal of waste,

the Municipal Board, upon application, may determine the matter, and its decision is final.

Local by-laws not applicable to Metropolitan Corporation operations R.S.O. 1960, c. 249

(12) No by-law of any municipality heretofore or hereafter passed pursuant to paragraph 112 of subsection 1 of section 379 of **The Municipal Act** or a predecessor thereof shall apply to the operations of the Metropolitan Corporation pursuant to subsection 2.

Existing contracts for disposal of waste

(13) Nothing in this Part shall affect any contract for the disposal of waste that is now existing between any person and any area municipality, but the Metropolitan Corporation and any such area municipality may enter into an agreement providing that the Metropolitan Corporation shall assume all or part of the liability created by such contract in respect of the disposal of waste. 1966, c. 96, s. 10.

PUBLIC ADMINISTRATION ASPECTS OF AREA-WIDE PLANNING

Hugh Mields, Jr.[*]

THE SURGEON GENERAL as he announced this conference remarked that "The solid waste problems of the metropolitan Washington area will not be effectively dealt with until the District of Columbia, the states of Maryland and Virginia, and the cities and towns surrounding Washington join together in a cooperative effort . . ."

That may very well be the *understatement* of the decade. It will take more than a cooperative effort on the part of all the governments in the metropolitan area — including the Federal Government — to develop a solution to the problem of adequately protecting our urban environment from the hazards and pollutants that threaten to inundate us.

It will take no less than an unqualified political commitment on the part of all the local governments in the area to convince the state legislatures to pass the laws, raise and spend the money, and delegate (relinquish) the authority necessary to restore our physical environment.

It will take, moreover, imagination, skill, dedication and drive on the part of the bureaucrats involved to make the need for *action now* more meaningful to the political policymakers involved. So far our *local* public servants have demonstrated their great defensive skills only.

A cooperative effort may be enough to indulge in area-wide planning as an exercise — but planning for program implementation must be the product of an institutional arrangement capable of making political decisions to act affirmatively over the long haul.

Action oriented area-wide planning can only be initiated *after* the governments of the metropolitan area agree on the nature of the problem threatening their jurisdictions and that it has regional significance. Also they must generally agree on the means they need to employ to meet the threat and they must agree on the kind of urban condition they want to achieve in the process.

Only after these decisions have been made and the regional goals agreed

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[*] Consultant, Wise/Gladstone & Associates.

upon can "public administration" take hold, and the administrators and technicians undertake area-wide planning for appropriate action programs.

The Critical Nature of the Problem

Secretary Gardner's Task Force on Environmental Health & Related Problems in its report *A Strategy for Livable Environment* released in June states: "Man lives in delicate equilibrium with the biosphere — on the precious Earth-crust, using and reusing the waters, drawing breath from the shallow sea of air. While these can cleanse themselves, they can do so only to a finite point. That point is being reached and passed in many places in the United States. It is not only necessary that we take preventive action, it is also urgent that we take steps to restore the quality of our environment."[1]

The Task Force Report effectively communicates a great sense of urgency. It is a sense of urgency which needs to be communicated to the governments of this metropolitan area.

The Task Force Report documents at some length the extent to which our expanding and affluent urban populations are generating vast quantities of progressively more complex gaseous, liquid and solid waste products.

It is becoming increasingly apparent that the sources of these waste products are interrelated and that the whole approach to the protection of the public health and well-being must be undertaken on a broad and coordinated basis. The development of adequate environmental protection system for the Washington Metropolitan area will require that we direct our attention to the full range of existing hazards and that we recognize the interrelationships between solid, gaseous and liquid wastes.

If we are to restore and to protect and enhance our physical environment, a comprehensive approach to the problem is essential. The program we must construct must be concerned with not only solid waste disposal problems but air quality, water pollution, water quality and supply, chemical and pesticide hazard control and all other threats to our environment and our physical well-being.

Setting Program Goals

The Task Force Report *A Strategy for Livable Environment* recommends that HEW's purpose for environmental concern be: "To ensure that every American can thrive in an attractive, comfortable, convenient and healthy environment by:

controlling pollution at its source,
reducing hazards

converting waste to use, and
improving the aesthetic value of man's surroundings."[2]

Having set this general goal the Task Force urges that this primary goal be related to a policy commitment toward the elimination of environmental contamination and that in addition program goals must be set for the reduction of specific contaminants. I believe that it is reasonable to suggest that this same set of goals can and should be acceptable to the governments, local, state, and Federal in the Washington metropolitan area and that there is no valid reason why these same governments cannot make the necessary policy commitment.

Setting Regional Goals

The kind of environmental protection system recommended by Secretary Gardner's Task Force has as its immediate objectives the establishment of criteria and standards for elements discharged into the air, water, and soil, and the creation of a surveillance system, nationwide for all pollutants in air, water, and soil.

The Task Force contains this admonition: "And compliance must be based on more than abatement action. There must be an inducement so strong for State and local governments to do comprehensive planning on an appropriate geographic scale and to conform with national goals and objectives that it is politically and economically unpalatable for them to do otherwise."[3]

The Task Force Report goes on to say "Participation on the part of local government in any regional environmental program should be as great as possible, but it must be recognized that environmental protection problems will have to be solved on the metropolitan or regional scale.

"We must engage in experimentation and research in order to increase our capacity to make decisions at the metropolitan or regional level."[4]

An Interstate Compact Agency Required

For the Washington metropolitan area it seems obvious that some kind of new institutional arrangement will have to be created to carry out an effective environmental protection program. It seems inevitable at this point that to mount the kind of environmental protection system needed to most adequately meet the problems of this area, an interstate compact agency will have to be created. The creation of such an agency will involve agreement on behalf of the states of Maryland and Virginia, the Congress and should be fully supported by the Executive Branch. Also it must be so structured so as to be genuinely responsive to the local governments in the area. As a matter of fact, I would urge that the Compact Agency be a component part of the Washington COG, which has already created an intergovernmental decision-making process.

The National Research Council of the National Academy of Sciences in its report *Waste Management and Control* stated that "Public policies and institutional arrangements, and the extent to which they are supported will largely determine the effectiveness with which the challenge of pollution is met." [5]

"Law and public policy establish the environment that will determine the response of private activities and individual public agencies to the problems of pollution. Because of the strategic role of governmental agencies at all levels in establishing this environment, or climate, their organization, staffing, financial support, and authority are critical to a successful attack on the problems of pollution." [6]

Neither the individual governments in the D.C. metropolitan area nor in any other metropolitan area are adequately equipped to deal with the problem on the scale required. The scale makes it impossible to solve on an individual basis, and jurisdictional problems effectively preclude any real hope for effective confederation. If the local governments in the area are to act responsibly, they must assume the obligation of supporting the creation of a new institutional arrangement or governmental entity which can meet the problem on the scale required to adequately protect and enhance the physical environment of the metropolitan area. And at the same time they must be sure that such an arrangement is not special purpose, but part of a general decision-making process for the region — one that deals with highways, outdoor recreation, health and all the other things that create an environment of excellence on the intergovernmental regional scale.

Area Wide Planning for an Environmental Protection System

The creation of a compact agency will take, however, at least from two to four years to accomplish. Much will depend on the zeal with which the local governments take on the job. But in any event, planning for the creation of the compact agency itself should begin now and should be undertaken as a specific goal of the Washington Metropolitan Council of Governments.

The principal talk of the compact agency committee would be to secure agreement amongst member governments as to: (1) the compact agency's specific responsibilities; (2) the kinds of powers, police, taxes, eminent domain, etc., to be placed at its disposal; (3) how it is to be organized, staffed and funded; (4) the kinds of standards it should impose and over what period of time; (5) how it should enforce such standards and secure compliance; (6) its relationships to the states and federal governments and most importantly — its relationship to the local governments within the metropolitan area.

But while the COG compact agency committee is pursuing its responsibilities COG itself should be working with the governments of the region in developing agreement on interim goals and an action program to meet those goals in the most constructive and effective way until the compact agency is a fact and is working.

This work, it would seem to me, would fall into two categories:

First, trying to meet the short term problems of eliminating the most obnoxious hazards to the metropolitan environment:

Shooting for a target of closing down all the open burning in the metropolitan area and particularly the Kenilworth Dump within the next six months.

Begin preparing for completion in 1969 a comprehensive environmental health program plan for the metropolitan area.

Begin to develop abatement plans to reduce plant stack emissions by 90 percent by 1970. In other words implement the recommendations made by COG in its model Air Pollution Ordinance.

Second, providing the basic information regarding the range and intensity of existing and potential hazards to the environment for purposes of further refining the area's short-term goals and to be used by the compact agency once it is created as a basis for its compliance and enforcement program.

Work undertaken in this regard would consist of the following: (1) a metropolitan wide monitoring system for air and water pollution; this would require an expansion of COG existing 11 stations air pollution monitoring network; (2) the development of a source inventory for solid, gaseous and liquid waste for the entire metropolitan area; (3) area wide solid waste disposal site survey; (4) analysis of the nature of the total solid waste loads along with the development of methods of analysis for alternative mixes of treatment. For example, how much waste should be burned, how much should be ground up, and discharged through the sewer system, how much should be buried, how much should be subject to salvage; (5) examination of existing private and public collection methods, etc.; (6) an intense and in depth examination of the total existing and projected impact of current prevalent environmental hazards on the ecologue of the metropolitan area; (7) undertaking a comprehensive analysis of the projected cost involved in the development of an effective environmental protection system and the examination of possible sources of revenue to support the protection program including recommendations as to the appropriate role in terms of financing to be played by the state and Federal governments.

Summary

The development of an effective environmental protection system will require a comprehensive approach involving all aspects of waste generation and taking into account the full range of environmental hazards within the framework of broad and responsible political decision making.

- It will have to operate on a regional scale
- It will require the full commitment and support on the part of all the governments in the area
- The work on the creation of an appropriate compact agency should begin now under the auspices of the Washington Metropolitan Council of Governments
- At the same time the governments of the metropolitan area should be working through WASH COG to develop short-term abatement goals — and programs to achieve those goals during interim between now and the creation of the compact agency
- Finally, every effort should be made on the part of the individual governments within the metropolitan area acting individually and in concert to secure and utilize all available resources and powers through the States and the Federal government to assist them in a truly cooperative effort to restore the Metropolitan area's physical environment.

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[1] The Task Force on Environmental Health and Related Problems. *A strategy for a livable environment: a report to the Secretary of Health, Education, and Welfare.* Washington, D.C., U.S. Government Printing Office, 1967. p. 1.

[2] *Ibid.* p. xv.

[3] *Ibid.* p. xii.

[4] *Ibid.* p. xiii.

[5] National Academy of Sciences — National Research Council, Committee on Pollution. Was *Waste management and control: A report to the Federal Council for Science and Technology.* Publication No. 1400. Washington, D.C., National Academy of Sciences — National Research Council, 1966. p. 222.

[6] *Ibid.* p. 222.

ASSISTANCE AVAILABLE UNDER THE SOLID WASTE DISPOSAL ACT

Richard D. Vaughan *

MAN HAS BEEN POLLUTING his environment for centuries. But recently in this country, as in other parts of the world, a rapidly growing population, increasingly concentrated in urban areas, has made pollution a critical problem. The metropolitan area of Washington, the point of focus for this conference, provides a concrete example of a highly concentrated urban area with increasingly severe pollution problems.

Until the last few years, pollution to most people meant unclean air and water. Few were concerned about contamination from solid wastes as long as their garbage and trash were routinely removed from their premises, and the disposal site was beyond the senses of sight and smell. Yet, in communities throughout the country, the burning of wastes in the open or in antiquated equipment is a major cause of air pollution. Moreover, open dumps often seriously pollute surface and ground waters.

Only today are we beginning to realize that our three waste repositories contain all we shall ever have of the basic life resources of land, air, and water and that these repositories are interconnected so that to pollute one may be to pollute all three.

In economic terms, as a nation we are now paying about $3 billion a year for solid waste handling systems which are less than adequate in many cases. The expenditure of local funds for solid waste is exceeded only by expenditures for schools and roads.

Although there is a great and pressing need for research and development in the technology of solid waste management, it must be emphasized that knowledge is now available for the development of safe and efficient solid waste handling systems. No community need wait for research results before *improving* waste management. Most municipalities, unfortunately, have lacked money to spend on available sanitary collection and disposal equipment and facilities, much less to risk on disposal methods not yet wholly tried. Furthermore, many communities now undertaking to dispose of solid wastes, are too small to afford to do much more than dump wastes in the open or burn them in the open or in primitive equipment.

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* Chief, Environmental Sanitation Program, National Center for Urban and Industrial Health, Public Health Service, U.S. Department of Health, Education, and Welfare. On August 1, 1967, the National Center for Urban and Industrial Health moved its headquarters to Cincinnati. At that time Mr. Vaughan became Chief, Solid Wastes Program, NCUIH.

The Solid Waste Disposal Act

There are reasons for optimism for the long-term outlook for effective solid waste management. One of the most important reasons is that, for the first time, we have a Federal commitment to support and assist in a coordinated national effort to solve solid waste problems. This commitment is embodied in Title II of Public Law 89-272, The Solid Waste Disposal Act. On October 20, 1965, the President signed the Act into Law.

The Act directs the Secretary of the Interior to aid in solving solid waste problems resulting from extracting, processing or using minerals or fossil fuels. All other responsibilities under the Act are assigned to the Secretary of Health, Education, and Welfare. On December 3, 1965, the Surgeon General of the Public Health Service established an organizational entity which is now designated as the Solid Wastes Program of the National Center for Urban and Industrial Health to carry out the HEW provisions of the Act, which are: ". . . (1) to initiate and accelerate a national research and development program for new and improved methods of proper and economic solid waste disposal, including studies directed toward the conservation of natural resources by reducing the amount of waste and unsalvageable materials and by recovery and utilization of potential resources in solid wastes; and (2) to provide technical and financial assistance to State and local governments and interstate agencies in the planning, development, and conduct of solid wastes disposal programs."

The Act authorizes specific action in six areas of need: (1) grant support for local and State projects to demonstrate new and improved waste disposal technology; (2) grant support for the development of area-wide solid waste management systems to end fragmentation of responsibilities among small communities; (3) grant support for State surveys of solid waste handling needs and the development of Statewide plans for meeting needs; (4) research, both direct and grant-supported, to establish the basis for new approaches to solid waste handling; (5) training programs, both direct and grant-supported, to alleviate critical shortages of trained personnel; (6) technical assistance to local and State governments with solid waste problems.

Clearly, the Act casts the Federal government in the role of supporting partner with local and State agencies in solving solid waste problems. Primary responsibility for solid waste handling and for carrying out programs for improved practices remains at the local and State levels.

Assistance Provided by the Solid Wastes Program

During the 19 months of existence of the Solid Wastes Program of the Public Health Service, and in the context of the purposes and specific actions authorized by the Solid Waste Disposal Act, much progress [illegible] been made, but much more remains to be accomplished.

The Solid Wastes Program, operating with a budget of about $12 million during F.Y. 1967, has emphasized fundamental approaches to the solution of solid waste problems. This is exemplified by the many communities which are attacking the basis of their disposal problems in projects, aided by Federal grants, to replace uneconomic and insanitary small community operations with area or regional waste management systems. Such systems will make it possible for communities cooperatively to avail themselves of the health-safeguarding technology and economies inherent in large-scale disposal operations. The projects would merge operations now being conducted individually by many — in one case, more than 50 — communities.

Demonstration Projects

Projects receiving grants to demonstrate new and improved disposal technology also are oriented toward basic solutions of the solid waste problem, such as demonstrating constructive uses for wastes. The use of wastes in reclaiming worthless land, for example, is to be demonstrated in a number of projects. One of these will show that wastes can be compacted to as little as one-tenth their original volume as they are being deposited in a sanitary landfill. Another project is to demonstrate long-distance rail transportation of wastes to abandoned strip mines and other land needing reclamation. Economic recovery of incineration heat to desalinate or purify water or generate power is to be established by several projects. To date approximately $7 million in grant funds have been or are in the process of being awarded for the support of 50 demonstration and study and investigation projects which are active across the nation.

In the Metropolitan Washington area a study and investigation project has been recently completed covering special studies leading to the design of Incinerator No. 5 for the District of Columbia. The total project cost was $94,000 of which $62,000 in grant funds were awarded by the Solid

Wastes Program. Presently, a study and investigation project covering the design of Incinerator No. 5 of the District of Columbia is active. This project will have a total cost of $390,000 of which $260,000 will be provided by a Solid Wastes Program grant.

Demonstration grants are awarded primarily to test the economic and technical feasibility of proposed methods. Study and investigation grants are awarded for the study of solid waste handling problems and practices. Work under this second category of grants leads to the demonstration of improved waste handling practices or may provide solutions for regional solid waste management problems. Up to two-thirds of the total cost of projects may be financed by Federal funds.

Recent administrative action resulted in the removal of a limitation on the amount of demonstration project funds that could be awarded to any one State. There is now no restriction, other than the budget of course, of funds to any one State for demonstration and study and investigation projects.

State Survey and Planning Projects

States across the country are surveying their solid waste needs and developing disposal programs with 50 percent of the costs provided by Solid Wastes Program grants. In many instances, this work has never been done before on a Statewide basis. Regional and even interstate systems are expected to be developed through this activity.

Planning grants are awarded to State and interstate agencies which have been designated or established as the sole agencies responsible for such State or interstate planning. The more important objectives of this type of grant include the enactment and strengthening of legislation, a data collection system to pinpoint solid waste problems and devise means of dealing with them, and the setting and enforcement of standards for the design and operation of solid waste management facilities and equipment. To date approximately $1.5 million in grant funds have been awarded for the support of 32 State survey and planning projects. The State health agencies in Maryland and Virginia both have active survey and planning projects. Recent administrative action also resulted in the removal of a limitation on the amount of survey and planning project funds that could be awarded to any one State.

Research Projects

Research projects supported by Solid Wastes Program grants are aimed at such basic solutions as the reduction of wastes at the source or their conversion into marketable products. One project, for example, seeks knowledge which would lead to the reduction of food wastes through the development of spoilage-resistant fruits and vegetables. Another is studying the conversion of wastes from citrus fruit processing into citric acid. The transformation of cottage cheese and tomato wastes into human and animal foods is the objective of another project. Several researchers seek to convert wastes into marketable carbon and chemicals. A number of new routes to incinerator heat recovery are being explored. One project is studying gassification of wastes to produce fuel for power generation. Over $2 million has been committed for grant-supported research in the 19 months since the Solid Wastes Program was established. Thirty-nine research projects are now active under grants awarded by the Program.

The Solid Wastes Program is developing a research capability of its own in facilities at Cincinnati. Arrangements have been completed for the construction in Cincinnati of the first field laboratory for general research on solid waste pollution abatement.

Training

The Solid Wastes Program sponsors or conducts training for all types of solid waste personnel. Shortages of technical personnel are being alleviated through grants to institutions of higher education to train graduate students in engineering and science. Operating and administrative personnel are being trained in courses conducted by the Program.

Training grants are awarded to institutions of higher education to establish and/or expand graduate training programs in solid waste technology and management. I might point out that very few graduate school candidates in the environmental health disciplines in the past have elected to do graduate work in the solid waste field because of the tendency of the engineering profession as well as public officials to give solid waste programs low priorities. It is believed that, through financial help to universities for enlarging solid waste educational programs and by assisting graduate students, the critical need for qualified personnel will be eased.

To date nearly $0.5 million have been awarded for solid waste training to the following institutions of higher education: Drexel Institute of Technology; University of Florida; Georgia Institute of Technology; University of Kansas; University of Michigan; Rensselaer Polytechnic Institute; University of Texas; and the University of West Virginia.

Technical Assistance

Engineers and scientists of the Solid Wastes Program are developing technical assistance capabilities as provided for by the Act for both public and private agencies. Members of the staff work on such tasks as the development of disposal performance criteria. These will form a basis for establishing performance standards and will be helpful to industry in designing equipment and techniques for meeting such standards.

An example of the technical assistance available is the study of the four District of Columbia incinerators which was made during the week of April 2, 1967, at the request of Senator Tydings of Maryland. A full report of the study was transmitted to Senator Tydings in June.

The Future

Not only is refuse increasing in volume, its characteristics are also changing rapidly. And the problems will unquestionably become more severe. The 165 million tons of solid waste polluting the air and discarded and spread over the nation's landscape in 1966 will increase to 260 million tons in a decade. Wastes which heretofore have been of a degradable organic nature have become mainly nondegradable inorganic material.

The Task Force on Environmental Health and Related Problems in their recently published report to the Secretary of Health, Education, and Welfare entitled *A Strategy for a Livable Environment* clearly identified future needs in waste disposal as follows: "Basic research into the health effects of waste and waste disposal techniques; the study of wastes as an element of disruption in the ecology of natural systems; a stepped-up research effort to secure breakthroughs in the re-use and disposal of solid, liquid, and gaseous wastes; a greater public awareness of its role and responsibility in curbing waste; a grant-in-aid program to assist State and local governments and private industry in establishing and maintaining adequate waste disposal systems; achievement of reduced levels of waste through improved packaging methods."[1]

Of a more specific nature are two identical bills which were introduced in the Senate on April 27 by Senator Muskie of Maine (S. 1646) and in the House of Representatives on April 28 by Representative Ryan of New York (H.R. 9477). The proposed legislation would amend the Solid Waste Disposal Act to provide for the construction of solid waste disposal facilities and for other purposes. Hearings have not been scheduled for either of the bills.

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[1] The Task Force on Environmental Health and Related Problems. *A strategy for a livable environment; a report to the Secretary of Health, Education, and Welfare.* Washington, D.C., U.S. Government Printing Office, 1967. p. 16.

Conclusion

Imagination and innovation are being manifested in action to solve the solid waste problem. It is clear, however, that the problem is of such increasing magnitude as to demand long-term application of the utmost in imaginative thinking and willingness to venture away from conventional approaches and develop new and improved methods for solid waste handling. The problems we are facing are more than those of technology and economics. They involve the American attitude toward wastes, which is one that generates a vast public disinterest in the proper management of wastes. As Dr. Stewart mentioned earlier the citizenry appears to be interested in solving their solid waste problem but only if the disposal site is located in someone else's backyard far, far away. This attitude is understandable if one correlates it with the opinion of Mr. John Q. Public of what solid waste management is or should be. In far too many cases the term solid waste disposal in the mind of the average citizen is associated with burning and smelly dumps or antiquated incinerators belching forth black and odorous smoke in gigantic quantities. Both images are not only insults to man's environment but are unnecessary. Solid waste disposal should be associated in the public's mind with immaculate operation, with the reclamation of land and other resources, with the development of parks and recreational areas, and with the beautification and improvement of the community. People must realize that proper solid waste management can result in an asset for their municipality not a liability. The complex technology of today's complex world has created solid waste problems which must be met straightforwardly and effectively by the professionals in this field with the full support of an enlightened and positive thinking citizenry. On the other hand to be content with the status quo — or to put it another way to be satisfied with yesterday's solution to today's and tomorrow's problems will most certainly lead to disaster for the community and the nation.

Much unfavorable publicity during recent months has resulted from the operation of the disposal site in the Washington metropolitan area known as the Kenilworth Dump. Such notoriety has certainly not been of value in associating in the minds of the populace what proper solid waste management should be. The Solid Wastes Program would welcome a proposal in the form of a demonstration grant application which would result in the replacement of the present Kenilworth Dump with a model sanitary landfill operation and land reclamation project resulting in the development of an architecturally pleasing recreation site as well as the immediate cessation of burning. This, I believe, would demonstrate to a large segment of the population, the transformation of a civic shame into something of which the entire metropolitan area can be proud.

If any area-wide approach to solid waste management and utilization of these wastes is to be successful, public attitudes must be improved. This conference is one large step in that direction. I hope that this conference will focus regional attention on solid waste management and the Metropolitan Washington area and tools available for solving the problems.

The Solid Wastes Program would welcome a proposal for the design and demonstration of a modern, efficient and safe solid waste management system for the Metropolitan Washington area. A proposal could be submitted by a body representative of the area, such as the Metropolitan Washington Council of Governments. Such a project would be eligible for up to two-thirds grant support as authorized by the Solid Waste Disposal Act.

The Public Health Service believes that through the Federal government's partnership with industry, State and local agencies, the challenge of solving one of the nation's more vexing environmental health problems — pollution-free disposal and utilization of solid wastes — will be achieved.

OPEN DISCUSSION: PANEL C

Walter A. Scheiber,[*] Panel Chairman

Mr. J. H. McCall[†]: Mr. Reid, please define the data developed by your consulting engineers for the financing of your regional plan in the Detroit area.

Mr. Reid: The firm we employed was Consoer, Townsend and Associates. Let me just read from my report. I brought this along to fortify myself since I'm not an engineer. I have instructions to say this is out of print. It was put out in 1964 and we've had almost as big a demand for it from outside the Detroit region as we've had in the region. If you're from around this area, I know there are three or four copies in various counties, regional and city offices around here, that you might refer to. In this report, we have tables of various types of financial data gathered. In order to arrive at costs, it was necessary to set up schedules of collection truck arrivals, number and size of unloading hoppers needed, size of transfer buildings, size of scale house, amount of railroad siding, number of loading ramps, amount of paved areas, number of lights in area, acreage required for loading stations and so forth. In the several tables we made for our two alternative plans, we cover such finance costs as transfer buildings, scale house and scales, railroad loading, vehicle storage, maintenance garage, paving, truck fueling items, exterior lighting, land acquisition, compactor trailers, fodder trailers, road tractors, service trucks, and so on. These specifications were also developed for the major sites recommended as regional disposal sites, and for the trucks and equipment needed to carry on those operations.

Mr. McCall: Mr. Reid, that is not the answer we were looking for. We're interested in the financing of the two alternative plans. Not in the basic cost saving and development thereof, but we're interested in how your engineers were recommending that these plans be financed.

Mr. Reid: Since we do not have an operating agency in the region that can implement this plan, it goes back to the counties through our supervisors intercounty committee for their first consideration. We just don't have any basis for saying any more than we ought to have a metropolitan service agency to carry on this operation and develop the cost. In general the operating cost would be paid by the cost per ton of refuse delivered at the various points or at the disposal sites by the companies involved. The initial cost I presume would have to be raised either by a bonding or by a capital financing program. That's the best answer I can give to it. We are pushing for the creation of an agency capable of doing this.

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[*] Executive Director, Metropolitan Washington Council of Governments, Washington, D.C.

[†] James H. McCall, Goodbody and Company, Chicago, Illinois.

MR. S. PROFILET[*]: Do you anticipate that the Program of Solid Wastes will generate any public information material aimed at increasing public acceptance of solid waste disposal practices as the practices ideally should be pursued?

MR. VAUGHAN: Yes. This will be accomplished through several mechanisms. through publicity connected with the demonstration grants and through straight public information which is aimed toward the housewife or the fellow next door. Wide distribution will be made of this material, through the Center office of public information, National Center of Urban and Industrial Health.

MR. W. SULLIVAN[†]: Are there any direct aids to industry under the Solid Waste Disposal Act to perform research and development on solid waste treatment?

MR. VAUGHAN: There are no direct aids as far as the grants are concerned. However, we do work a great deal with industry through the contract mechanism.

MR. SULLIVAN: How about money being used as state government aid then given to industry for work for the state government as a grant?

MR. VAUGHAN: The money that is given to the state government for state planning grants, the state could in turn use a portion of (these funds) for consultant purposes.

MR. HENRY EPPES[‡]: Does the Metropolitan Toronto area include any unincorporated area?

MR. ROSS L. CLARK: The answer is *no*. Metropolitan Toronto as we said comprises six municipalities, one core city and five boroughs. It also has surrounding it, and included in the Metropolitan Planning area, five townships. Each of these townships is quite extensive in size, but under the provincial statutes each is incorporated.

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[*] Stephen B. Profilet, Washington Suburban Sanitary Commission, Hyattsville, Maryland.

[†] William E. Sullivan, Electronic Associates, Inc., Rockville, Maryland.

[‡] M. Henry Eppes, Maryland Technical Advisory Service, University of Maryland.

Going back to the question of Mr. Reid. We finance operation of our refuse disposal system now, simply by presenting a budget for the year at the Metro-Council level. This year, it will be $4 million. Capital cost payments are also added to the metro-levy. This total levy is then prorated against each member municipality in relation to its assessment over the whole assessment of the metro area.

Mr. E. F. Menke*: The question is 'In the greater Metropolitan Area, would it require a new agency for solid waste disposal or would the existing structure of the Metropolitan Washington government suffice?'

Mr. Scheiber: The Council of Governments is a voluntary association assisting major local governments in the Metropolitan Area including the District and 14 suburban governments. It does not have the kind of legal standing in our opinion which would suffice to make it adequate for the kind of solid waste disposal programs which we've discussed during this two-day conference. Mr. Mields suggested this morning that in all likelihood it would be necessary to negotiate and enact an interstate compact. This would create an organization with legal power, such as the power to condemn land, the power to borrow money by bond issue and other similar powers which are generally thought to be necessary in order to develop a viable solid waste disposal program. COG at the present time does not have such powers and we do not envisage that we will receive them in a general way in the foreseeable future. Therefore, I think those of us on the COG staff generally would subscribe to the suggestions made by Mr. Mields during the previous statement.

Mr. O. Sutermeister†: I have two short questions. The first is about Mr. Clark's comment on the new section of the Public Health Act governing landfill site use.

Mr. Clark: Perhaps, when I was quoting the Public Health Act in talking about the finished site, I didn't finish my statement. There shall be no utilization of a finished landfill site for a period of 25 years unless a specific proposal is put forward and is accepted by the Provincial Department of Health. For instance, we don't like to see any buildings or structures put on top of a finished landfill site. But a new approach to development is to put buildings on piles to keep two or three floors clear and open for parking with no basement boiler rooms. Boiler rooms, of course, are starting to appear on the top part of some of our buildings rather than the basement.

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* Eric F. Menke, Washington Citizens for Clear Air, Washington, D.C.

† Oscar Sutermeister, U.S. Public Health Service, Washington, D.C.

Mr. Sutermeister: Where does the authority to approve the future use lie?

Mr. Clark: With the province of Ontario under the new Public Health Act.

Mr. Sutermeister: Not with the metro area?

Mr: Clark: We must conform with provincial requirements.

Comment: This is not a direct question, but I'm afraid that some of those who are here might be under the impression that there are no properly operated sanitary landfills in the Metropolitan Washington area. There is one old sanitary landfill in Fairfax County, in the Bailey's Crossroads area, which is now the center of a very concentrated commercial area. We did have some problems with construction here (methane). We had to do some mucking out, which was not the most pleasant thing in the world. It was concentrated under one large high-rise type building. We have another sanitary landfill, which was closed down about three years ago. It's in the grand process of being converted into a recreational area. We have a police rifle range and training center there. We have a currently operated sanitary landfill. It is not without problems and we do have the usual citizen opposition that everyone has mentioned in the location of landfills.

Mr. Sutermeister: Mr. Clark showed slides of a watercourse in a completed landfill. The watercourse seemed to me as a mere channel of concrete. A landscape architect in designing the plan for recreational usage might have some objections to this type of structure. Is there any alternative to such structures?

Mr. Clark: Actually, if you noticed on the left side of that slide there was rubble stonework laid in concrete. That was all done in ground aesthetic color to blend in with the park approach of using natural wood and things like this. In the other part it was like concrete and eventually it will be lined on top in brown stone to blend in much more naturally. There are twenty-two feet of refuse underneath that area. We did have to carry the watercourse through in concrete because this is part of our water pollution control program. We don't want the old watercourse seeping down through the refuse and then leaching through underneath into the adjacent river.

LUNCHEON ADDRESS

William B. Spong, Jr.[*]

I AM VERY PLEASED to be here with you. I assure you that as slowly as I speak, I won't speak very long; I will speak rather informally to you. I will talk a little about air pollution, which of course is related to solid wastes disposal.

I commend this subject as a dinner conversation piece for you. When I was first married, my wife used to take me off to dinner parties and I would find myself seated with nice ladies with whom I couldn't possibly find anything to talk about. When I returned home, I would say, "Well, Virginia, I did the best I could; I just couldn't seem to strike up any conversation that we had a mutual interest in." She said, "Well, I'll tell you; I learned a long time ago that the one thing you can talk about is termites — everybody has had some experience with termites; it's amazing — you can just sit there and the evening will be cool and you just say something about termites and you will just be amazed — everybody knows something about termites." And so I tried this for 15 or 16 years. Since I have been in the Senate of the United States, which is now just under seven months, I have found that air pollution works almost as well as termites — everyone has some opinion about it, the cause of it, the cure of it; everyone has had some experience with it, and therefore I commend to you on any evening when the conversation is pretty dull as far as you are concerned, just (you don't have to talk about the Kenilworth Dump) — just talk about air pollution, and you will be amazed to see what opinions and reactions that it brings forth.

The day before yesterday, the Senate, by a vote of 88 to 0, passed the Air Quality Act of 1967. The bill as passed was far different from the bill initially introduced and recommended by the Administration. I think that Senator Muskie, who was the chief patron of the bill, and the chairman of the subcommittee, should be commended for getting the bill through the Senate in the manner that he did. What the House will do with the bill remains to be seen.

I thought that for 10 or 12 minutes, I would review informally the principle thrust of the Bill in its present form. This will allow you to become acquainted with what the Congress — or at least the Senate — is trying to do insofar as Federal participation in attacking the problem of air pollution is concerned. I think one of the foremost provisions is money for research. We know, of course, that the burning of low-grade fuel is one of the chief causes of the pollutants in the air that have been adjudged most harmful to individuals. And we know that a great deal of meaningful research is already being done. We visited Riverside at the University of California, and saw what they are doing in terms of the effects of air pollution on plant life and the effects on animal life. We know that a great deal can be done insofar as low-grade fuel burning is concerned. Much is being done in many other parts of the world that should be helpful to us in attacking this cause of air pollution. I will talk now about what the Bill provides insofar as motor vehicles are concerned. Many States do not have mandatory inspection of automobiles; they have spot checks in California to determine if the anti-pollution equipment, which must be installed in every automobile beginning next year, is continuing to function properly; they can spot check it. They can stop the car and check to see if the equipment is in the car, and if it is connected. They cannot determine (unless they test the vehicle) whether the equipment actually is functioning properly and whether that equipment and the other equipment in the automobile is being properly maintained. I would hope that the research funds will produce not only economic hardware which can be installed in every automobile, but also testing equipment which will make it easier and cheaper to follow up a spot check or used as part of a mandatory inspection.

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[*] United States Senator from Virginia.

The greatest problem in our deliberations on the Air Quality Act of 1967 was determining how standards would be determined. We in the United States are free and independent and we don't want somebody from Washington, regardless of how attractive and personable he may be, sniffing at every smokestack in the United States to find out what's going on. It was decided that the best thing to do was to allow the states to determine the minimum standards that they wanted enacted in this field.

The principle thing that this bill provides insofar as the role of the Federal government is concerned is the research that HEW can do to inform people throughout the United States about the problems, dangers and types of air pollution, and about the regions in the United States where the greatest problems exist. Then, within a period of a year to fifteen months, the individual States can enact minimum standards of their own.

The only field that the Federal government has pre-empted for the setting of emission standards is the area of motor vehicle pollution. The one exception to this is the State of California, which has had its own standards for two years. But each State will have a reasonable period of time in which to enact minimum standards. I am hopeful that each and every one — the States of Maryland and Virginia have both moved forward in this direction already — will adopt their own standards and come in under this Act.

Insofar as automobiles are concerned, it's impractical not to have national standards. If we allowed each individual State to set its own emission standards for motor vehicles, then the manufacturers of motor vehicles would have to manufacture different hardware for the different localities in which their automobiles are operated. The cost of this would certainly be passed on to the automobile purchaser, and I think it is completely unrealistic not to approach the problem of motor vehicle air pollution from the basis of national standards.

In this particular area, regardless of the Kenilworth Dump, the motor vehicle remains the greatest problem. Here in Washington we have the heaviest concentration of automobiles I believe of any metropolitan area in the United States. In Los Angeles, where they pride themselves about the number of automobiles they have, they were very surprised when we advised them that there are more automobiles per capita here in the Washington Metropolitan area than in Los Angeles County or in the immediate Los Angeles area.

Now, the Secretary of HEW will set forth regional airsheds. He will designate the regions where air pollution is a problem, and certainly Metropolitan Washington is a region that will be designated. There will be hearings on Senator Tydings' bill this afternoon. It seeks to set up a control board for the District of Columbia, Maryland, and Virginia. All three of these political subdivisions will be in a position to work together within a designated region to attack this problem.

The first stage, an inventory of the potential causes of air pollution, has already been underway in the District of Columbia for some time. In Los Angeles County they say that the only problem that they have in air pollution is the result of the motor vehicle. They say they have inventoried, identified, cataloged and done everything necessary to control 90 to 95 percent of the air pollution from stationary sources in the Los Angeles area. They have secured convictions in 90 percent of the cases initiated and they say that stationary sources of air pollution, unlike most metropolitan areas, are the least of their worries and problems. The four main things that the Air Quailty Act of 1967 seeks to do is: (1) to provide research immediately in this area; (2) to encourage the States and the localities within the States to adopt standards that will enable that particular region or that State to combat air pollution in its own way, but which will meet minimum requirements; (3) to encourage States, through grants, to provide for inspection of automobiles to determine that the equipment installed in the automobile and required under previous legislation is operating to combat air pollution; and (4) to set up regional airsheds. If there is an emergency, such as happened at Donora, Pennsylvania, or last Thanksgiving in New York City, and a locality and a State have not set up sufficient legislation and administration to meet that problem, then the Federal government can move in immediately.

I think there should be some exploration in the field of tax incentives to encourage industries to install equipment to combat the problem, and I think that Congress will be considering this in the near future.

The thing that has impressed me about the Bill the Senate passed unanimously day before yesterday is that it follows in many respects the pattern set in the Clean Water Act. It enables the States and the localities to take the initiative without pre-empting very much from them. It provides scientific and technical data to the localities and to the States.

Now, we have, both in the House and in the Senate, a Solid Wastes Disposal Bill which I predict ultimately will follow this same pattern. The pattern recognizes the necessity for local and State initiative, for local, State and Federal cooperation, and for regional planning.

We are mindful that America is becoming rapidly urbanized. I live in the southernmost part of one great urban complex, which extends from north of Boston down into Virginia. I live in Hampton Roads, the southernmost portion of that complex. And whether we are talking about solid wastes disposal, mass transit, air pollution, or planning or zoning or noise abatement, we are coming to realize that an entire new concept of the environment of the individual of tomorrow is going to take place. It will require the utmost cooperation between the various experts in these fields, because they all relate to each other whether they be engineers or architects or planners, or health officers. They must see a total concept in which we begin to understand and deal with all of these things at one time. We have also come to realize that man is not on an island. The District of Columbia can't proceed with solid wastes disposal plans or with air pollution plans unless those in the neighboring communities in Maryland and in Virginia are planning and working with them on this problem.

I think the most meaningful thing about the legislation I have discussed is that it sets a pattern which is consistent with the American concept and yet recognizes the role that the Federal government must play. It demands initiative by the States if the problems are to be met, and it encourages regional planning and regional cooperation. As a Virginia Senator I have had a great deal of fun in the last four or five months advising my constituents in Richmond that whether they know it or not they are polluting the District of Columbia; they don't always take that too kindly, but it's true — depending on the prevailing winds, we are either doing damage to Baltimore or Richmond or they are doing damage to us here in the District of Columbia.

I commend you upon this conference; I believe Senator Tydings' legislation for the District in this area will pass. I know that the Solid Wastes Disposal Bills are going to have full hearings. But the success of any of these undertakings in the world in which we live today demands the cooperation and the planning of many people in many different walks of life and of many, many political subdivisions.

SUMMARY OF PANEL A
PRESENT PRACTICES AND NEEDS IN THE METROPOLITAN AREA

Achilles M. Tuchtan, Panel Chairman

MR. SVORE, LADIES, AND GENTLEMEN: Yesterday afternoon in the Panel on Present Practices and Needs in the Metropolitan Area we had the opportunity to hear six well-qualified speakers, who have had broad experience with the problem, discuss individual aspects of the solid waste problem in the metropolitan area.

Mr. Bremser, whose firm has studied the problem for the Northern Virginia Regional Planning Commission, the Maryland National Capital Park and Planning Commission, and the Metropolitan Washington Council of Governments, told us of the quantities of waste now being produced in the area, and of the means used to dispose of that waste. He estimated the quantities of waste that will be produced in the future, and told us something of what will be required to dispose of that waste.

Dr. Middleton discussed the present relationship between solid waste disposal and air pollution. Mr. Binnewies and Mr. Eastman told us of the problems and accomplishments of the Federal Government in disposing of the solid wastes that arise as the result of Federal government activities in the metropolitan area.

Mr. William Vogely analyzed for us some of the asthetic aspects of the problem of removing junk automobiles from the streets and vacant lots of the region and returning them to the channel of available natural resources.

Mr. Bosley, recognizing the fact that many persons have realized that solid wastes disposal is now becoming a regional problem, discussed some of the legislative measures that will be necessary to bring about a regional solution to the problem.

Mr. Vogely's remarks on the magnitude of the junk automobile problem were truly enlightening. It appears that the rate of recycling of scrap metal from junked automobiles just about equals the rate at which cars are being abandoned, so that a large backlog of abandoned vehicles continues to remain almost untouched. If the entire supply of junk automobiles is to be removed from our communities, Mr. Vogely recommended that automotive scrap be given competitive advantage over other types of scrap. I might add here that the Council of Governments has begun to seek a solution to

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the problem in the metropolitan area, and has requested assistance from the Bureau of Mines in obtaining some of the specific information it must have if a sound policy is to be developed.

There is no question, however, that the major solid wastes disposal problem in the metropolitan area at present is the disposal of ordinary residential and commercial refuse. Refuse production for the entire region in 1965 was estimated at 1.3 million tons of incinerable refuse and 0.5 million tons of nonincinerable refuse. Mr. Bremser estimated that by the year 2000 the region would be producing 4.5 million tons of incinerable refuse and 1.6 million tons of nonincinerable refuse.

Nearly one half of that waste arises in the District of Columbia and much of that half comes from Federal installations. Mr. Eastman of the General Services Administration told us of the extensive problems, and of the monumental accomplishments, of his agency in dealing with the wastes collected from 55 million square feet of office space in 1,300 separate buildings. Wastes are segregated, and sold wherever possible. Ingenious solutions have been provided for the specialized problems presented by classified documents, flourescent light tubes, and medical supplies, but much of the Federal solid wastes still find their way into the normal municipal solid waste disposal channels. These wastes include the nonsaleable wastes from the General Services Administration, along with the over 300,000 cans of trash which Mr. Binnewies reported were collected in the National Parks of the region last year.

Mr. Bremser described the present manner of the disposing of solid wastes within the region. Three methods are used for waste disposal: incineration, sanitary landfilling, and open burning.

Because of the lack of landfill space, Arlington County, Montgomery County, the City of Alexandria, and the District of Columbia use incineration to reduce the volume of solid waste prior to final disposal. Alexandria and the District of Columbia are also required to use open dumps to dispose of wastes which cannot be processed in their existing incinerators. Sanitary landfilling is employed in Prince Georges, Charles, Fairfax, and Prince William counties.

Because it has been necessary to rely on open burning to dispose of those wastes which exceed incineration and landfill capacity, the solid waste disposal problem has also become an air pollution problem.

Dr. Middleton noted that almost 900,000 tons of refuse are burned annually in municipal and private incinerators and that approximately

160,000 tons of refuse are burned in open dumps, mostly at the Kenilworth Dump. He declared that efforts to reduce air pollution from refuse disposal can at present most profitably be concentrated in the District of Columbia. He stated that closing of the archaic Kenilworth Dump is an essential first step. In order to close down the Kenilworth Dump as well as other open burning in the region, it is necessary that alternate facilities be provided.

Mr. Bremser stated unequivocably that land for landfills and incinerator plants is the greatest present and future refuse disposal need of the Washington metropolitan region. He noted that the region does not have the natural conditions which make sanitary landfilling the ideal refuse disposal method that it is for some other large urban areas. Geological and hydrological conditions in the northern half of the region are generally unfavorable for sanitary landfill; conditions are more favorable in the costal plains region of the southern half of the area but that transportation costs to the region would be high.

Mr. Bremser concluded that more incinerator plants will be needed in the future.

Dr. Middleton, on the contrary, expressed the belief that the best solution to the problem is to stop all burning of refuse. However, he recognized that the Washington area must eventually run out of suitable space for landfilling. In view of this, he suggested that incinerators in each building be dispensed with. He suggested that if wastes must be burned they should be burned in modern, well-operated municipal incinerators equipped with the best available air pollution control devices. Both Mr. Bremser and Dr. Middleton agreed that effective solution of the solid waste problem, accompanied by the elimination of air pollution, will require extensive cooperation among the individual jurisdictions concerned.

Mr. Bosley described some of the mechanisms by which such cooperation could be established. He noted that the District of Columbia had already requested the Council of Governments to investigate a means of establishing a regional solid waste disposal program. As a result he had determined that, as an interim mechanism, it would be possible to create a nonprofit corporation to undertake the disposal of solid wastes. However, such a corporation would have neither the power of eminent domain nor the ability to obtain long-range financing. As a result, it could not engage in long-term landfill or incinerator operations.

An alternative to the nonprofit corporation would be the establishment of a metropolitan authority under interstate compact. Mr. Bosley expressed his personal opinion, however, that such a regional authority should have responsibility for all of the metropolitan environmental health problems rather than be established solely to solve the solid waste problem. From the outset, such an interstate authority should be the joint agency of the local governments in the area and its governing body should be composed of local elected officials rather than state appointed officials.

The six speakers yesterday afternoon placed clearly in perspective the nature of the solid waste disposal problems of the metropolitan area. The consultant's report recommending specific solutions will become available within a month or two. By considering carefully both what we have learned in the past two days and the recommendations of the consultant, we will be in an excellent position to join efforts and reach a solution to this very pressing problem which will benefit us all.

I want to thank the speakers who appeared on the panel with me, and I want to thank the Surgeon General for convening this conference so that we would have this excellent opportunity to review the solid waste problems of the region.

SUMMARY OF PANEL B: TECHNOLOGY TODAY

Abraham Michaels, Panel Chairman

THE TECHNOLOGY TODAY session concerned itself with solid waste collection, transportation, and disposal methods currently in use in this country and abroad and with newly developed or developing technology in refuse processing. Clear indications that the *technology* is currently available to solve the refuse disposal problems for the Washington metropolitan area were offered. Both sanitary landfilling and incineration techniques suitable for use in this area were discussed, and refuse transfer systems which would be used in conjunction with disposal methods were described. The recycling and utilization of refuse particularly by salvaging and composting were also reviewed and discussed in detail.

The first speaker, Mr. Bugher, stated that Solid Waste transportation systems for a given area require answers to the following questions: (a) How large is the area to be served? (b) Should the removal system handle all the solid wastes generated in the area? (c) What is the distribution of the various kinds of waste generating units in the area? (d) What is the area's existing and the potentially available total transportation system?; and (e) Who will finance and administer the system?

Mr. Bugher noted that "the present Washington transportation system, with its highways, railroads and the Potomac River, allows the waste removal planner a wide range of alternatives for system development in terms of both the mode of transportation and the ultimate destination." He based his opinion on the knowledge that "(a) wastes can and must be disposed of in an unobjectional manner; and (b) wastes can often be used to increase the value of marginal land."

The author discussed waste transportation methods in terms of those currently available and developing, and suggested that research efforts now being undertaken will develop improved systems in this field. Existing transportation systems mentioned included: (a) pipelines — operated hydraulically or pneumatically — originating at the point of waste origin; (b) railroads and barges for long-distance transportation; (c) integrated transfer stations; and (d) truck and trailer systems with their potential for increasing their pay loads.

Mr. Bowerman said that aside from unacceptable open dumping and open burning, the most commonly practiced solid waste disposal method in the

U.S. is that of sanitary landfilling. This is so because it has widespread applicability, low operating cost, freedom from nuisance and pollution, and opportunity for reclamation and enhancement of land. In addition, sanitary landfilling may often be the quickest and most convenient means for transforming an open dump or open burning operation into an acceptable procedure. Suitable equipment for sanitary landfilling is readily available. The operating techniques are well proved and the required skills are well within the range of operating agencies. In other words, it's easy.

Certain minimum functions must be performed in order that the operation be truly classified as a sanitary landfill; the solid wastes must be deposited, compacted, and covered promptly; blowing paper, flies, rats, fires, and other nuisances must be avoided through the rigorous maintenance of a tight cover to seal in the compacted wastes; protection must be afforded against rain erosion, and ground water pollution. The ultimate land use must be planned, preferably before the commencement of operation, so that maximum benefit will be derived from available cover material and final topography will be developed at minimum cost. Some examples of final use are as follows: golf courses; regional parks, playgrounds; skeet ranges; archery ranges; ski mountains with planned slopes for skiing, tobogganing, and sledding; heliports; parking areas; and offshore islands for recreational or airport use.

Six "refuse" reduction processes were reviewed by Mr. Kaiser: (1) open burning at dump sites; (2) burning in conical metal chambers; (3) landfilling, sanitary or otherwise; (4) composting, with sale of compost; (5) incineration without heat recovery; (6) incineration with heat recovery.

Reduction in volume is basic to any of these processes while any reduction of weight is of lesser importance.

Open burning has been banned in some six states while in others limitations of open burning are in effect. Volume reduction by open burning is poor and incomplete, causing air pollution and leaving nuisance causing organic and putrescible matter in the residue.

Conical metal burners which were designed to burn sawmill wastes have been used to burn industrial and municipal refuse. Although proper operation may achieve a greater reduction in refuse weight and volume than open burning, this device creates appreciable air pollution and produces a poor quality residue.

The art and science of incineration in America have developed to such a degree that large incinerators currently in operation do meet reasonable air pollution and residue quality standards. Some European incineration plants have been constructed as refuse fired boilers utilizing more sophisticated air pollution control equipment than is currently used in the U.S. The gaseous effluents of these European plants is reported to be of better quality than of the good American plants.

Dr. Harding said that composting, or aerobic stabilization of putrescible material in refuse, can be achieved under controlled conditions, which include grinding, moisture control, and adjustment of the carbon-to-nitrogen ratio.

Three mechanical composting systems and the PHS-TVA Johnson City Plant were discussed in some detail.

Arrangements for the salvage of paper, cardboard, rags, ferrous metal, and glass should be made in advance with local brokers. Prices vary widely and are often not sufficient to pay for the cost of separation.

The author suggests that dumping fees be adequate to cover the disposal phase including capital outlays, a sinking fund to replace equipment, operating costs and disposing of the compost for at least two years while a market is developed for the product. The revenue derived from the sale of the compost should cover the by-product costs including final grinding, upgrading, marketing, granulating, bagging, etc. He noted that the principle use of compost is for agricultural purposes. It is expected that much useful information will be produced as a result of the Johnson City demonstration plant.

We had a very interesting question and answer period. Many pertinent questions were raised during the discussion period relative to the air pollution contributions of incinerators and tepee burners, the disposal of abandoned automobiles, the salvageability of refuse, the disposal of plastic wastes, the percentages of solid waste which is noncompostable, the potential heat value of refuse for use as a fuel, and the characteristic differences between American and European refuse. The importance of properly trained and compensated personnel was emphasized.

It is apparent that the technology is now available for the development of a nuisance-free solid wastes handling and disposal system for the Washington metropolitan area, and the Public Health Service, Solid Wastes Program which provides for research, demonstration grants, personnel training, etc., should further stimulate significant advances to the benefit of the Washington metropolitan area and the rest of the nation. This is the report of *Technology Today.*

SUMMARY OF PANEL C: DEVELOPMENT OF A REGIONAL SOLID WASTE DISPOSAL PLAN

Walter A. Scheiber, Panel Chairman

An analysis of the conference program makes it clear that the three panels are designed to complement each other, so that taken together, they will provide a comprehensive picture of the entire solid waste problem in the Washington metropolitan area.

Yesterday Mr. Tuchtan's panel dealt with the scope of our solid waste problem. Mr. Michaels' panel this morning provided a review of the state of our technology. And in Panel C, upon which I am reporting to you now, we discussed the factors to be considered in the development and in the implementation of a regional solid waste disposal plan.

In a sense, this facet of the problem is the most complex and the most delicate part of the entire equation, because it involves not only technical factors, but political, economic, and human considerations as well. As Dr. Stewart has said: "There is no technical barrier to sanitary and acceptable solid waste disposal. The barriers are chiefly political and economic."

In discussing the need for long-range planning to surmount these barriers, Paul Reid, Executive Director of the Detroit Metropolitan Area Regional Planning Commission, described the efforts in his metropolitan area to develop and implement an effective long-range solid waste management plan. He suggested that there were a number of general principles to be drawn from the Detroit experience which might be applicable within the Washington area, as well. Among these were the following: (1) that only a region-wide long-range plan, properly implemented, can work; (2) that a combination of landfill and incineration is a most appropriate disposal arrangement for a major urban area, such as the Detroit area or the Washington area; (3) that collection and transfer stations be spotted in the core area, and that highway and rail transportation be utilized to deliver waste and incinerator ash to landfills on the fringe; and (4) that a metropolitan-wide service agency be established to implement the plan.

Mr. Reid stated that in looking back on the Detroit experience since 1954 he believed that although their effort has been generally successful, there would be certain things the Detroit people might do differently if [illegible]re

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given a second chance: (1) they would seek the aegis of a region-wide policy body such as the Metropolitan Washington Council of Governments and the new Council of Governments in the Detroit area as a sponsor for their efforts; (2) they would ask for joint and active support from the Department of Housing and Urban Development and Department of Health, Education, and Welfare in terms both of technical and financial assistance; (3) they would make greater use of citizens' advisory groups to work in parallel with the technical advisory committee in order to generate greater community cooperation; (4) they would work in closer conjunction with park and recreation specialists in developing landfill sites.

Our second speaker, Mr. Clark, who is Director of Works of the municipality of Metropolitan Toronto, described the experience of his city over the past fourteen years in developing an effective solid waste disposal program for a metropolitan region with almost exactly the same population as that of our area, that is approximately 2.5 million people. He described the structure of Metropolitan Toronto, which was created in 1953, and which is essentially a confederation of local governments in the Toronto region with operational and with regulatory powers significantly greater than those enjoyed by most American cities not excluding the District of Columbia. He pointed out that it had been recognized shortly after Metropolitan Toronto was created that solid waste disposal was a problem which should be solved on a regional basis. Notwithstanding this fact, during the first years of the Toronto experience refuse disposal remained the responsibility of the member municipalities. By 1965, however, the problems of solid waste disposal had become so great that the individual municipalities could no longer properly handle the waste disposal system. A Royal Commission was appointed in that year to study the problem and it recommended that the Metropolitan Corporation assume responsibility for all waste disposal in the area.

On January 1, 1967 solid waste disposal became the responsibility of the Metropolitan Corporation. All properties and equipment in use for solid waste purposes were transferred by the local governments to the Metropolitan Corporation without cost. And this is certainly a novelty for those of us who participate in American local government. The Corporation was given authority to acquire land for solid waste disposal purposes anywhere in the metropolitan area, which consists of approximately 700 square miles, subject to the approval of the municipality in which the land is located.

The major lesson to be learned from the Toronto experience, we think, is that a high degree of cooperation between this local community and the regional body is an absolute must in a successful operation. Although the Canadian political and organizational structure is considerably simpler than ours in the United States, the Toronto experience demonstrates the high level of cooperation to which we in the Washington area must aspire.

Mr. Hugh Mields, our third speaker, a consultant associated with the firm of Harold F. Wise Robert Gladstone, Associates of Washington, spoke about the public administration aspects of regional solid waste planning. He expressed the belief that mere cooperation among the local governments of the Washington area would not be a sufficient basis for the development of a comprehensive waste management program and he urged that immediate consideration be given to the creation of a new Interstate Compact Agency for the National Capital Area. He expressed the belief that such an agency must be structured to be jointly responsible to the local governments of the region, as did John Bosley in his remarks in Panel A. He indicated, however, that the creation of such an agency would take between two and four years to accomplish in his judgment and urged that work be begun immediately as a special project of the Metropolitan Washington Council of Governments.

While long-range work on a new compact agency, which requires the approval of the state legislatures of Maryland and Virginia as well as the Congress of the United States is under way, he suggested that interim action be taken by the Council of Governments in two directions: (1) getting the Kenilworth Dump closed, beginning the preparation of a comprehensive health plan for the Metropolitan area and developing abatement plans on stack emissions; (2) providing basic information regarding the range and intensity of existing and potential environmental health hazards.

Mr. Mields strongly urged that any compact agency created pursuant to the long-range negotiations should be associated with and a part of the Council of Governments, if possible.

Our final panel speaker, Richard D. Vaughan, Chief of the Environmental Sanitation Program of the National Center for Urban and Industrial Health, described Federal assistance available under the Solid Waste Disposal Act of 1965.

He told of the accelerated research and development program of grants in the field of solid waste, and various types of technical and financial assistance available to state, local and area-wide bodies.

Among the features of the Act which he felt to be important, he described the following: (1) demonstration grants for economic and technical innovations in the solid waste field; (2) grants to develop area-wide solid waste systems; (3) grants for state surveys and the development of state-wide plans; (4) grants for research to establish new approaches in solid waste handling; (5) training grants; and (6) technical assistance to local and state governments with solid waste problems.

Mr. Vaughan reported on two grants recently made to the District of Columbia in connection with the design of Incinerator No. 5. He also reported that the states of Maryland and Virginia as well as the District had received grants to develop state surveys and state plans.

In closing, Mr. Vaughan stated that the Solid Wastes Program would welcome a proposal for a demonstration grant which would result in the replacement of the Kenilworth Dump with a model sanitary landfill operation and land reclamation project which would result in the development of an architecturally pleasing recreation site as well as the immediate cessation of open burning. He also told the panel that the Solid Wastes Program would welcome a proposal for design and demonstration of a modern solid waste management system for Metropolitan Washington, and suggested that such a proposal could be submitted by a body representative of the area, such as the Council of Governments. Such a project, he pointed out, would be eligible for up to two-thirds grant support under the Solid Waste Disposal Act.

As Panel C concluded, the panel chairman indicated his belief that the Council of Governments would respond affirmatively to this suggestion.

CONFERENCE SUMMARY—A PATTERN FOR ACTION

Leo Weaver

A FEW SHORT WEEKS AGO, when we began the planning for this conference, we decided to list these concluding remarks in the program under the heading, *A Pattern for Action.*

Frankly, it somewhat worried me: how I or anyone else could presume to stand up here and spell out a pattern for action when our discussions and deliberations are barely concluded.

As it turns out this is not really such a difficult assignment. I think it is abundantly clear that the pattern for action to solve the solid waste management problem of the metropolitan Washington area is inherent in the problem itself. Our task is to remove whatever blinders may prevent us from taking a realistic look at this problem. When we do that, I think the outlines of a pattern for action become unmistakably clear.

This is a time to be realistic. We are striving to find a solution for a *real, tangible, sordid,* and *worsening* problem. But, we are no closer to solving it today than we were yesterday morning when Mr. Svore opened this Conference.

This afternoon and tomorrow afternoon, next week, next month, and perhaps next year, a match will kindle the fire at Kenilworth and prove once again that we have not yet begun to see and understand the solid waste problem of this community.

The fact that the District of Columbia has had to rely on an outrageous open burning dump for nearly a quarter of a century to meet much of its solid waste disposal needs proves beyond any doubt that this community is playing a dangerous game of self-deception.

And not only the Federal City is playing the game. The communities in Maryland and Virginia that ring the City of Washington are equally guilty of self-deception when they blithely berate the District for the Kenilworth disaster, and yet do virtually nothing to help bring it to an end.

And the self-deception goes deeper than that for these same surrounding jurisdictions — some of the most rapidly growing urban areas in the country — will face the same kind of problem which now plagues the District of Columbia.

Where will these suburban areas turn when their waste disposal problems equal or dwarf those of the District? The time when we will be forced to answer that question is not far off.

And while we are being realistic, let's not kid ourselves into the comfortable notion that the Kenilworth Dump is the sum and substance of the Metropolitan Washington solid waste problem. The dump is the scapegoat. It is the most obvious, tangible proof. But it is not the whole problem.

What about outmoded and poorly operated municipal incinerators? What about single-chamber, flue-fed incinerators? What about open dumping and open burning in all parts of this region? Can we turn our backs on these offenses as though the plume of smoke from Kenilworth hid them all?

The answer is obvious.

If there has been one overriding viewpoint taken by speakers at this Conference it is that solid waste management is a regional problem which must be solved by a systematic, regional approach. Some speakers have given lip service to this idea — others have made it the major premise of their remarks.

But regionalism is not a pattern for action. What I want to do in the few minutes before the fire at Kenilworth obscures our view is try to suggest what seemed to me to be transcendent goals that will have to be carved out and met both for the short- and long-term solution of the solid waste problems of this area.

Goal number one: stop forever the burning at Kenilworth. Put the fire out 30 days from today and let it never be lighted again.

It is incredible that every single person, be he public official or not, who has any knowledge of or responsibility for the Kenilworth Dump wants the burning to stop. And yet it goes on. I say our first goal must be an end to the fire at Kenilworth no more than one month from today.

Goal number two: as soon as the fire is out, begin a sanitary land reclamation operation at Kenilworth that will demonstrate to the entire community what *can* be accomplished when the best available technology moves in to replace the worst. Let the District of Columbia, with whatever outside help it needs, make Kenilworth a symbol to the people of this entire region of what *can* be accomplished when the problem of solid waste disposal is dealt with scientifically and in the best public interest.

We need more parks and recreational facilities in Washington. Let's make one out of the disgrace that is the Kenilworth Dump. The Public Health Service is ready to do whatever it can toward this goal.

For goal number three the District of Columbia should proceed immediately with the development of plans for an interim replacement for the Kenilworth Dump. If that replacement is to be located at Muirkirk, Maryland, let the District develop and submit for public scrutiny a plan to use that site for the benefit of the people.

I have to say in all candor that the residents of Muirkirk have every reason to *fear* what might happen if their community is used for disposal of solid wastes from the District of Columbia. But we know that a landfill operation at Muirkirk, or anyplace else in this area, can be conducted in a way that will enhance, rather than degrade, the surrounding community.

Let us begin now to earn the confidence of the people whose help and understanding are needed. And then let us repay that confidence with a waste disposal operation that is of the highest possible calibre.

It can be done.

Goal number four: the governments serving the people of the metropolitan Washington area, which share what we all agree is a regional solid waste management problem, should immediately come together, probably under the auspices of the Metropolitan Washington Council of Governments, to create a permanent commission responsible for coordinating the solid waste disposal programs of the region, monitoring operations, reviewing plans, setting immediate and long-term goals, and promoting a coordinated regional system for solid waste management in the metropolitan Washington area.

Such a commission should undertake, as one of its major tasks, the development of an interstate compact governing solid waste disposal and perhaps other environmental health problems in the metropolitan area of Washington. I see no reason why such a commission could not be operating by the first of the year. I assure you the Public Health Service will provide every ounce of assistance it can to make this goal possible.

In a few minutes this conference will be over. It can have accomplished a great deal — or nothing. It can have been the first, long overdue step toward control of one of this area's most serious environmental health problems. Or it can have been only an exercise in futility.

But let me say only this. If a realistic look at the solid waste problem brings into sharp focus a pattern for action, it also shows us with painful clarity what will happen if we *fail* to act.

Each of us knows what his professional training, political acumen, and good common sense tell him must be done to solve the solid waste problems of this community. Our pattern for action is to do what is right, and do it now.

CONFERENCE ADJOURNMENT

Jerome H. Svore

In the area of water pollution control in the past few years we have heard various figures of what it is going to take to clean up the water environment of this nation. Just to separate sanitary sewers from the storm sewers is estimated to require about 30 billion dollars. Treatment plant construction alone calls for grants on the Federal level of 5 to 6 billion dollars which will be matched locally. This doesn't even begin to solve the pollution problems of agricultural drainage, return flows from irrigation, and the idustrial wastes of the nation. This indicates the level that we are talking about as far as this type of pollution is concerned; and that's only one pollution!

We had an example of the Senate's indication of how they felt about air pollution when they authorized a 700-million-dollar program on a matching basis with regional areas, municipalities and others. This does not include the cost of what industry is going to have to do to solve their problem; and that's the second pollution.

Certainly, the third pollution is going to require similar resources. I think that many of us in the professional business of pollution control over the years have been lagging behind public opinion in many instances. I certainly hope that as a result of this conference the necessary impetus will be given to the situation in the Metropolitan Washington Area, so that we can go forward with correcting the present situation.

Are there any comments from anyone from the floor? I give you an opportunity at this time.

Norman E. Jackson*: I have no prepared speech, nor do I have a place on this program. But I felt that there should be someone from the District of Columbia to say just a word in parting that we are not really what you may have been led to believe we are. We are just as much interested in solving this problem as you. I am a resident of the District of Columbia. I take no great pride in Kenilworth, nor, do I think, does the Engineer Commissioner or any other officials of the District of Columbia. We are very much interested in getting your help.

Let me assure you that the people in the District of Columbia are working toward this problem. We have been at it quite a while. We suggested undulating the contours of Kenilworth landfill — some years ago — that was unacceptable; maybe we did not have the proper persuasiveness. But we do need the help of not only the people in the District, but those in the outlying areas. We proposed the use of Muirkirk as you heard today. Prince Georges County has our proposal before it for consideration at the present time. But I think that of all things we need to point out, the most important is that those areas or those portions of the District which cannot go any further than their present bounds for those areas needed to solve its problems and in this we must have the help of the outside areas. We have much work to do on our part as well: to better our operation, to improve our methods of doing things. This we are willing to do.

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* Norman E. Jackson, Government of the District of Columbia, Washington, D.C.

Mr. Chairman, thank you very much for the opportunity of letting these people know that we are interested in this, and that the District, at least in the closing moments, has had opportunity to present its viewpoint. Thank you very much.

Mr. Svore: We sincerely appreciate those words of your Mr. Jackson, and I am sure that any support that this conference ultimately gives you will be appreciated. If there are no further comments, this meeting will stand adjourned and we thank you all for coming.

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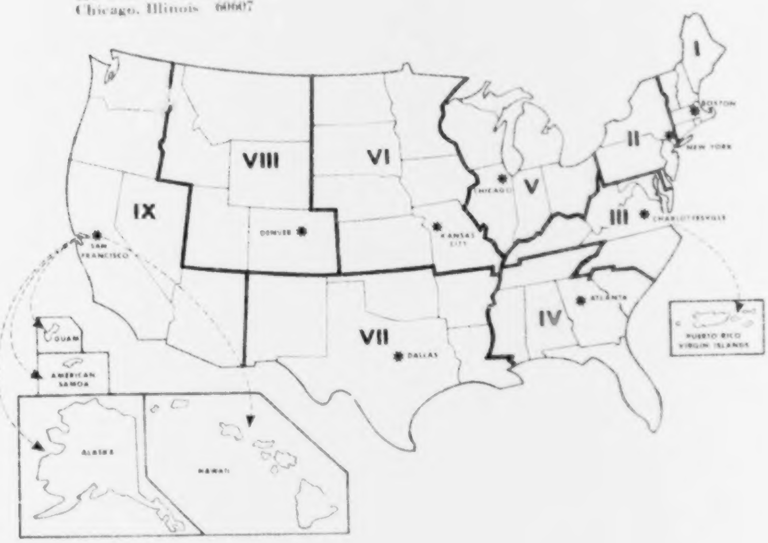
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